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The Engineer

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PUBLIC NOTICES

The Director-General, India Store Department, Branch No. 95, Belvedere-road, Lambeth, S.E. 1, invites TENDERS for—
1. INDIA-RUBBER RINGS, WASHERS, &c., for Vacuum Brake.
2. 12,500 HOSEPIPES, without Couplings, for Vacuum Brake.
3. NINE SHUNTING LOCOMOTIVES, with Tenders, for 5ft. 6in. gauge.
4. 50 SETS of CYLINDERS for Locomotives.
Tenders due on the 27th January, 1928, for Nos. 1 and 2; on the 7th February, 1928, for No. 3; and on the 20th February, 1928, for No. 4.
Forms of Tender obtainable from the above at a fee of 5s. per set, which will not be returned. 7464

Applications are Invited for an APPOINTMENT of DRAGLINE INSPECTOR in the service of the Punjab Government.
Candidates should be under 40 years of age and preferably unmarried, and should hold a Diploma in Mechanical Engineering from a recognised Engineering Institution in the United Kingdom. They must have undergone a regular workshop training, preferably with a firm engaged in the manufacture of Dragline Excavators, whether of steam, electric or Diesel oil prime movers, and have had experience in the working of such excavators. The selected officer will be required to control the working of a fleet of small draglines operating in different areas, principally on the digging of seepage and storm water drains in out-of-way places. He may also be required to advise and assist in keeping other kinds of machinery in good working order.
Five years' agreement in the first instance. Salary at a rate to be fixed within the scale Rs. 1000-50-1450 a calendar month, according to age and qualifications. First-class passage to India and return passage on satisfactory termination of service. Strict medical examination.
Forms of application and further particulars should be obtained from the SECRETARY TO THE HIGH COMMISSIONER FOR INDIA, 42, Grosvenor-gardens, London, S.W. 1. Last date for receipt of applications 25th January, 1928. 7426

Applications are Invited for the POST of PROFESSOR OF CIVIL ENGINEERING, BENGAL ENGINEERING COLLEGE, SIBPUR, BENGAL.
Candidates must be not less than 30 nor more than 40 years of age. They must hold an Honours Degree in Engineering and have had practical experience in Civil Engineering, and must be Members or Associate Members of a recognised Institution of Engineers. Preference will be given to candidates who have had some University teaching experience.
Salary Rs. 700 a month, rising by annual increments of Rs. 50 a month to Rs. 900. In addition, overseas pay of £25 a month will be granted to an officer of non-Asiatic domicile. Appointment on agreement for five years in first instance, with possibility of extension. Free first-class passage to India. Provident Fund. Free unfurnished quarters, subject to payment of municipal taxes. Strict medical examination.
Selected candidate will be required to join the appointment at the beginning of November, 1928.
Further particulars and forms of application may be obtained upon request by postcard to the SECRETARY TO THE HIGH COMMISSIONER FOR INDIA, General Department, 42, Grosvenor-gardens, London, S.W. 1. Last date for receipt of applications 1st February, 1928. 7427

Assistant Engineer Required by the KENYA and UGANDA RAILWAY for the CONSTRUCTION DEPARTMENT. Salary £600 a year. Outfit allowance of £30 on first appointment. Free quarters and passages and liberal leave on full salary.
Candidates, age 29-35, should have had experience on Railway Construction. Preference will be given to Associate Members of the Institution of Civil Engineers.—Apply at once by letter, stating age, qualifications and particulars of experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting M/158. 7423

Assistant Engineers Required by the PUBLIC WORKS DEPARTMENT of the FEDERATED MALAY STATES for four years' service, after which, subject to satisfactory service, the officers appointed will be eligible for confirmation in the permanent and pensionable establishment. It is probable that the number of permanent appointments will be sufficient for those officers whose services have been entirely satisfactory, but no guarantee can be given. If at the end of four years' service an officer's services have been entirely satisfactory and he is not offered or declines further employment, he will be paid a bonus of 2850 dollars. Salary 400 dollars a month, rising to 800 dollars by annual increments of 25 dollars plus a temporary non-pensionable allowance of 10 per cent. for bachelors and 20 per cent. for married men. The exchange value of the dollar in sterling is at present fixed by the Government at 2s. 4d., but its purchasing power in Malaya is considerably less than that of 2s. 4d. in the United Kingdom. No income tax at present imposed by the Federated Malay States Government. Free passages provided. Candidates, age 23 to 26, preferably unmarried, must have received a good theoretical training, preferably at a University or College recognised by the Institution of Civil Engineers and possess a Civil Engineering Degree or obtain such other diploma or distinction in engineering as the Secretary of State may decide in any particular case, or have completed articles with a Civil Engineer of good standing, and have passed the examination for Associate Membership of the Institution of Civil Engineers. In addition candidates must have had at least one year's practical experience of Civil Engineering under a qualified Civil Engineer.—Apply at once by letter, giving brief details of qualifications and experience and stating age and whether married or single, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting clearly at the head of application M/15224. 7309

The Institution of Chemical Engineers.
EXAMINATIONS, 1928.
Application forms (returnable 12th March, 1928) and particulars of the Associate-Membership Examinations for 1928, together with the Memorandum on "The Training of a Chemical Engineer," may be obtained from the Hon. Registrar, C. S. GARLAND, Esq., Institution of Chemical Engineers, Abbey House, Westminster, London, S.W. 1. 7458

Assistant Engineers (5) REQUIRED by the GOVERNMENT of NIGERIA for the PUBLIC WORKS DEPARTMENT for two tours of not less than 12 nor more than 18 months' service in the first instance. Subject to satisfactory service, the officers appointed will be eligible at the expiration of three years' service for confirmation in the permanent and pensionable establishment. Salary £480, rising to £920 a year. Outfit allowance of £60 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates, preferably between 25 and 35 years of age, must have passed the examination for A.M.I.C.E. or possess a degree in civil engineering recognised by the Institution as exempting from Parts "A" and "B" of the examination. Must have had proper technical training and preferably have had not less than two years' subsequent experience on large Engineering or Municipal Works.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting M/254. 7422

The Government of India REQUIRE the SERVICES of an ASSISTANT FOREMAN for the Acid Section of the Cordite Factory, Aruvankadu (Appointment 102).
Candidates should have had considerable experience in an Acid Works, and in particular have a thorough knowledge of:
(A) Nitric Acid Manufacture (from Nitrate of Soda),
(B) Sulphuric Acid Manufacture (Chamber process),
(C) Concentration of Sulphuric Acid (Kessler process),
(D) Treatment of Residual Acids from Guncotton and Nitro-glycerine.
Preference will be given to a candidate who, in addition to the above qualifications, possesses a knowledge of mixing acids for manufacture of guncotton and nitro-glycerine. Applicants should be between 25 and 35 years of age and capable of controlling labour.
TERMS.—Salary Rs. 450-15-510 per mensem, with prospects of further increases. Agreement for five years in the first instance. Free second-class passage to India and return passage on satisfactory termination of services. Free quarters. Medical examination.
Further particulars and forms of application may be obtained on request by postcard (quoting Appointment 102) from the SECRETARY TO THE HIGH COMMISSIONER FOR INDIA, General Department, 42, Grosvenor-gardens, London, S.W. 1. Last date for receipt of applications 28th January, 1928. 7457

Indian Railway Service OF ENGINEERS.
The Secretary of State for India in Council will in 1928 make TWO APPOINTMENTS of ASSISTANT EXECUTIVE ENGINEERS in this Service. European British subjects of non-Asiatic domicile only are eligible.
Candidates must have attained the age of 21 and must not have attained the age of 25 on 1st January, 1928.
They must either (1) have obtained one of certain recognised University Degrees, or (2) have passed Sections A and B of the Associate Membership Examination of the Institution of Civil Engineers or have been exempted from that Examination, or (3) have passed the Associateship in Civil Engineering of the City and Guilds Institute, or (4) produce evidence that they are otherwise qualified under the Regulations. They must in addition have had at least one full year's practical experience of Civil Engineering under a qualified Civil Engineer.
Applications must reach the India Office not later than 1st April, 1928. Application forms and full particulars may be obtained from the SECRETARY, Services and General Department, India Office, Whitehall, S.W. 1. 7442

The Government of INDIA REQUIRE TWO INSPECTORS OF STORES (STRUCTURAL), for service in the Indian Stores Department. Candidates must possess a University Degree in Engineering, or good general education up to the standard of the Institution of Civil Engineers or of the Institution of Mechanical Engineers, and drawing-office experience, and have served a regular apprenticeship in structural engineering workshops. It is essential that they should have specialised in structural steel and bridge work. Age preferably between 24 and 28 years of age.
Agreement for five years in the first instance. Pay at the rate of Rs. 500, rising by annual increments of Rs. 50 to Rs. 750 a calendar month, with certain allowances. Free first-class passage to India. Provident Fund.
Further particulars and forms of application may be obtained upon request by postcard to the SECRETARY TO THE HIGH COMMISSIONER FOR INDIA, General Department, 42, Grosvenor-gardens, London, S.W. 1. Last date for receipt of applications 28th January, 1928. 7425

Assistant Engineers Required by the GOVERNMENT of NIGERIA for Road Survey and Construction, for two tours of from 12 to 18 months' service, with possible extension. Salary £480 a year for three years, then £510, rising by annual increments to £920 a year. Free quarters and passages and liberal leave on full salary. Outfit allowance of £60 on first appointment. Candidates, age 26-35, should have had experience of Road and Bridge or similar Construction, Surveying and Levelling, and be competent to Set Out and Supervise Work and Control Labour, or be University Graduates (minimum age 21), in which case practical experience is not essential, but some knowledge of Surveying and Levelling is required.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/15093. 7460

Civil Engineer Required by the GOVERNMENT of IRAQ for the IRRIGATION DEPARTMENT for two years on probation, leading in the case of satisfactory service to a 10 years' contract. Salary Rs. 650, rising to Rs. 800 a month by annual increments of Rs. 50 a month. Free passages and liberal leave on full salary. Candidates, unmarried and between 23 and 26 years of age, should have passed Sections A and B of the A.M.I.C.E. examination, or hold an exempting University Degree, and have had not less than a year's practical experience on engineering work.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/223. 7467

The High Commissioner for India is prepared to receive APPLICATIONS for TWO APPOINTMENTS as ASSISTANT EXECUTIVE ENGINEER in the Public Works Department, Buildings and Roads Branch, Bengal. The appointments will be on agreement for three years in the first instance, with the prospect of permanent appointment thereafter. Candidates should be not more than 24 years of age and preferably unmarried. They must either (1) have obtained a University Degree in Civil Engineering, or (2) have passed Sections A and B of the A.M.I.C.E. Examination, or (3) have passed the Associateship in Civil Engineering of the City and Guilds Institute (Imperial College of Science and Technology), or have obtained such other Diploma or Distinction in Engineering as may be considered acceptable in any particular case. In addition, they must have had at least one year's practical experience of Civil Engineering under a qualified civil engineer. Those whose qualifying diploma has been obtained without a college course should have had a full three years of such practical experience.
Pay at the rate of Rs. 625 per mensem. Free passage to Calcutta. Provident Fund.
Further particulars and forms of application may be obtained upon request by postcard from the SECRETARY TO THE HIGH COMMISSIONER FOR INDIA, General Department, 42, Grosvenor-gardens, London, S.W. 1. Last date for receipt of applications 28th January, 1928. 7443

Armstrong College,
NEWCASTLE-UPON-TYNE.
(IN THE UNIVERSITY OF DURHAM.)

COURSES for the PASS DEGREE of B.Sc. and the HONOURS DEGREE of B.SC. in MECHANICAL, MARINE, CIVIL or ELECTRICAL ENGINEERING, MINING, METALLURGY, or NAVAL ARCHITECTURE. The curricula of the Pass Degree and the Honours Degree normally occupy periods of three and four years respectively, but candidates presenting evidence of sufficient previous training may be allowed to proceed to either Degree after two years' residence.

The engineering laboratories have recently been extended, and all Departments are equipped for advanced tutorial and research work.

Full particulars of the Courses may be had on application to

THE REGISTRAR,
Armstrong College,
7059 Newcastle-upon-Tyne.

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PUBLIC NOTICES

Borough of Swindon.

ELECTRICITY DEPARTMENT.

The Corporation of Swindon invite TENDERS for the SUPPLY, DELIVERY and ERECTION of TWO ELECTRICALLY OPERATED OVERHEAD TRAVELLING CRANES for the New Generating Station at Moredon and the New Main Sub-station.

Specifications and forms of Tenders may be obtained from Messrs. Preece, Cardew and Rider, 8, Queen Anne's-gate, Westminster, S.W. 1, on payment of a deposit of £2 2s., which will be refunded on receipt of a bona fide Tender within the prescribed time.

Sealed Tenders, endorsed "Tender for Cranes," must be delivered to me at my office not later than 10 a.m. on Saturday, the 28th January, 1928.

The lowest or any Tender will not necessarily be accepted, and the Corporation will not consider any Tender which is not in accordance with the specification.

ROBT. HILTON,
Town Clerk.

Town Hall, Swindon,
11th January, 1928. 7455

Nottingham Corporation.

The Nottingham Corporation invite TENDERS for the undermentioned WORKS in connection with the Plant Extensions at North Wilford Power Station, viz.:—

EXHAUST, WATER and other PIPE WORK, VALVES, TANKS, &c.

Specifications and forms of Tender may be obtained from Messrs. Preece, Cardew and Rider, 8, Queen Anne's-gate, Westminster, S.W. 1, on payment of a deposit of Two Guineas, which will cover the issue of the specification in duplicate and which will be refunded on receipt of a bona fide Tender within the prescribed time.

Extra copies of the specification may be obtained on payment of 10s. per copy, which will not be returnable.

Sealed Tenders, endorsed "Electricity Department, Tender for Pipe Work," must be delivered to me at my office before 10 a.m. on Saturday, February 4th, 1928.

The lowest or any Tender will not necessarily be accepted, and the Corporation will not consider any Tender which is not in accordance with the specification.

By Order,
W. J. BOARD,
Town Clerk.

Guildhall, Nottingham,
January, 1928. 7370

Port of Bristol Authority.

EXTENSION OF THE ROYAL EDWARD DOCK, AVONMOUTH.

SIXTEEN 2-TON ELECTRIC CAPSTANS.

The Port of Bristol Authority is prepared to receive TENDERS for SIXTEEN 2-TON ELECTRIC CAPSTANS for the Eastern Arm of the Royal Edward Dock and for the No. 4 Granary, Royal Edward Dock, Avonmouth.

On and after Monday, the 16th January, 1928, copies of the specification and contract drawing can be obtained from the undersigned on production of a receipt showing that a deposit of £3 has been paid. ALL CHEQUES MUST BE MADE PAYABLE to the "PORT OF BRISTOL AUTHORITY" and forwarded to the General Manager and Secretary, Port of Bristol Authority, Docks Office, 19, Queen-square, Bristol. The deposit will be returned to bona fide tenderers after the receipt of the Tender with all the prescribed documents and drawings.

Tenders must be enclosed in a sealed envelope, endorsed "Tender for Electric Capstans," addressed to the General Manager and Secretary of the Port of Bristol Authority, 19, Queen-square, Bristol, and must be delivered to him before 10 a.m. on Monday, the 30th day of January, 1928.

The Port of Bristol Authority does not bind itself to accept the lowest or any Tender.

THOMAS A. PEACE,
Chief Engineer.

Chief Engineer's Office,
Avonmouth Docks, Bristol,
13th January, 1928. 7456

Mersey Docks and Harbour

BOARD.
ENGINEER-IN-CHIEF.

The Mersey Docks and Harbour Board invite APPLICATIONS for the POSITION of ENGINEER-IN-CHIEF to the Board, which will be vacant at the end of June.

Candidates, who should be under 50 years of age, must be Members of the Institution of Civil Engineers and have had good experience in Dock and Harbour Construction and Maintenance and also in Estuary and River Training Works.

Applications, stating salary required, age, qualifications and experience, accompanied by copies of not more than three recent testimonials, to be sent to the undersigned not later than March 31st, 1928.

L. A. P. WARNER,
General Manager and Secretary.

Dock Office, Liverpool,
January 9th, 1928. 7454

Sunderland and South Shields

WATER COMPANY.
FOR SALE.

65 K.V.A. GENERATING SET.

Sulzer 85 B.H.P. Diesel Engine; Oerlikon Generator, 3-phase, 440 v., 40 cycles. Complete in every respect with all usual spare parts. New and practically unused.

TWO CENTRIFUGAL PUMPING SETS.

Rating 1500 g.p.m., 140ft. Oerlikon 100 B.H.P. Motors, 3-phase, 440 v., 40 cycles; Sulzer Single-stage Pumps.

TWO CABLE WINCHES AND CABLES.

Winches by Siemens Bros., driven by 5 H.P. Motors, 3-phase, 440 v., 40 cycles. Drums will take 550ft. of cable outside dia. 24in.

Two Lengths, about 260ft. and 240ft., Special Armoured Cable, by Siemens Bros. Three-core, to transmit 400 H.P. at 3000 volts.

STEEL PIPING.

About 780 Feet of 8in. Steel Piping, by Stewarts and Lloyds, in lengths of about 18ft., with loose flange joints. Test pressure 600 lb.

Above may be inspected at any time on application and offers sent to

ALFRED B. E. BLACKBURN, M. Inst. C.E.,
29, John-street, Sunderland. 7461

Surrey County Council.

HIGHWAYS AND BRIDGES DEPARTMENT.
APPOINTMENT OF ASSISTANT ENGINEER.

APPLICATIONS are INVITED for the APPOINTMENT of ASSISTANT ENGINEER, to act under the general direction and control of the County Surveyor.

Salary £500, rising by annual increments of £20 to £600 per annum.

Applicants must have a thorough knowledge of and experience in the modern construction and maintenance of Roads and Bridges and of general highway administration, and be capable of managing and controlling all works in connection therewith.

Candidates must not be more than 40 years of age, and preference will be given to candidates who are Associate Members of the Institution of Civil Engineers or Members of the Institution of Municipal and County Engineers.

The appointment is subject to the provisions of the Local Government and other Officers Superannuation Act, 1922, and the successful candidate will be required to pass a medical examination and to contribute 5 per cent. of salary to the Superannuation Fund.

Canvassing, directly or indirectly, will disqualify.

Forms of application may be obtained from the undersigned, to whom applications on such forms, accompanied by copies of not more than three recent testimonials, must be delivered in sealed envelopes, endorsed "Assistant Engineer," by the 25th January, 1928.

DUDLEY AUKLAND,
Clerk of the Council.

County Hall, Kingston-on-Thames,
10th January, 1928. 7458

PUBLIC NOTICES

DIESEL ENGINES FOR SALE.

Tenders are Invited for the

PURCHASE of ONE 4-CYLINDER, AIR INJECTION, FOUR-CYCLE, SULZER DIESEL ENGINE, direct coupled to 200-volt D.C. dynamo, 140 r.p.m.

Also ONE 3-CYLINDER SET as above.

These are giving an output of 400 and 300 kW respectively, and may be seen running in London by appointment. They are being removed to make room for larger sets, and will be shut down on 1st March. They must be cleared by 1st April.

Apply to the CHIEF ENGINEER, The Charing Cross Electricity Supply Co., Ltd., 60, St. Martin's-lane, W.C. 2. 7460

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

NOTIFICATION. — Re ASSISTANT SUPERINTENDENT.—Will the numerous Applicants for the post advertised kindly accept this intimation that a SELECTION HAS BEEN MADE.—WATTS, WATTS and CO., Ltd., 7, Whittington-avenue, London, E.C. 3. 7429 A

WANTED, CAPABLE ACCOUNTANT to Take Complete Charge of Costs and Statistics in Engineers and Scientific Instrument Makers' Office. Good salary and prospects.—Apply, stating age, full details of experience, and salary required, to "ENGINEER," c.o. Wykes and Co., Chartered Accountants, Leicester. 7451 A

WANTED, CHEMIST for Research Laboratory, with Honours Degree or equivalent. Sound experience in Metallurgical Analysis essential. Knowledge of Metallography an advantage, but not essential. —State experience in detail, age, salary required, to Labour Dept., JOHN SUMMERS and SONS, Ltd., Shotton, near Chester. 7431 A

WANTED, CHIEF ENGINEER for STEEL WORKS, with experience of Maintenance of Rolling Mills, Electrical Steam and Hydraulic Plant. State full particulars and salary required.—Address, "CHIEF," Wm. Porteous and Co., Advertising Agents, Glasgow. P4030 A

ABRASIVE WHEELS, &c.—Large Manufacturing Concern, with world-wide reputation, REQUIRES energetic REPRESENTATIVES. Proved selling ability and personal connection among engineers, &c., essential. Applications should contain full details, references, &c.—Address, P4043, The Engineer Office. P4043 A

ASSISTANT CIVIL ENGINEER REQUIRED for post abroad, A.M.I.C.E., age 25 to 35 preferred, with experience in Railway Maintenance and Construction Work; knowledge of Spanish desirable.—Write, giving full particulars, age, training, experience, whether married or single, &c., to "H. S.," c.o. Street's, 6, Gracechurch-street, E.C. 3. 7444 A

CONSTRUCTIONAL STEEL WORK and REINFORCED CONCRETE DESIGNERS REQUIRED IMMEDIATELY. Only men with first-class experience and good technical training in these branches will be considered.—Address replies, stating age, experience, and salary required, 7468, The Engineer Office. 7468 A

MACHINE TOOL SALESMAN. Must be Thoroughly conversant with up-to-date Automatic and Turret Lathe Practice and possess a first-class machine shop experience, particularly in Automobile Work. Also be able to give production times from drawings. Would be required to travel provinces. Fullest particulars of experience, &c.—Address 7450, The Engineer Office. 7450 A

REQUIRED by Firm of Gearing Specialists, having R headquarters in London, young ENGINEER SALESMAN, to travel throughout the country.—Write, giving full details as to age, experience, education and salary required, to Box 103, c.o. Mather and Crowther, Ltd., 10-13, New Bridge-street, E.C. 4. 7436 A

REQUIRED IMMEDIATELY, Capable GENTLEMAN with thorough knowledge of German and Machine Tool Trade. Must have initiative and be able to attend to extensive correspondence.—Address in own handwriting, stating age, qualifications and references, 7356, The Engineer Office. 7356 A

REQUIRED IMMEDIATELY, FITTING SHOP SUPERINTENDENT, with wide practical knowledge of Petrol and Paraffin High-speed Engines; must be capable organiser, able to control labour to obtain maximum output. Reply, stating experience.—Address, 7430, The Engineer Office. 7430 A

SALESMAN WANTED Who is Intimately Acquainted with first-class engineering establishments in London and Midlands area. Must be fully qualified engineer, with previous experience as salesman essential.

Practical knowledge of Lubrication Problems an advantage.

To take charge sales of high-class Engineering Accessories.

Address, stating full particulars of experience, qualifications, references and salary expected, P4029, The Engineer Office. P4029 A

THE PHŒNIX OIL and TRANSPORT CO., Ltd., has VACANCIES for recent Graduates holding the degree of B.Sc. (Engineering) as PROBATIONERS in OILFIELD ENGINEERING in Roumania. Preference will be given to men with practical training, but possession of the above degree is essential.—For particulars apply in writing to the COMPANY'S OFFICES, 9/13, Fenchurch-buildings, Fenchurch-street, London, E.C.3, stating degrees held and experience shop and/or drawing-office. 7459 A

SITUATIONS OPEN (continued)

TRAVELLER. — Wholesale Motor House has VACANCY for TRAVELLER in Garage Equipment. Engineers' salesman experience suitable. Travelling experience and connection with Lancashire garages essential.—Write, stating age, experience, if can drive car, if disengaged, and salary, "G." Box 260, c.o. Roy Hardy, Ltd., 49, Chancery-lane, W.C. 2. 7424 A

YOUNG ENGINEER REQUIRED as Assistant at Cement Factory, Spain. Shop experience essential. Salary about £240 and free accommodation.—Address applications, giving full particulars, 7462, The Engineer Office. 7462 A

WANTED IMMEDIATELY in London, DRAUGHTSMAN, with experience in Steam Power Station Construction; Electrical Knowledge desirable.—Write, stating age, experience, salary expected, and when free, to Box No. 362, c.o. Judd's, 47, Gresham-street, E.C. 2. 7450 A

WANTED (Temporarily) DRAUGHTSMEN, Several, by large manufacturing concern. Applicants must be conversant with Lay-out of Plant, Pipe Lines, Structural Steel, Building Works, &c.; Knowledge of Reinforced Concrete an advantage.—Address, 7446, The Engineer Office. 7446 A

CEYLON FIRM of General Engineers REQUIRE first-class ENGINEER, DRAUGHTSMAN, DESIGNER and ESTIMATOR (25-28, single), to Take Charge of Drawing-office employing native draughtsmen. Applicants must be regularly trained engineers, with indentures and technical qualifications. Experience in Constructional Ironwork Design, Machine Design and Millwrights' Work essential; knowledge of Building Construction an advantage. Candidates must be able to execute and direct the preparation of complete designs, details, estimates, specifications, with connected correspondence, and, when necessary, overlook erection. Agreement for four years, passage, salary Rs. 500, rising to Rs. 650, six months' leave on half pay provided new agreement entered into. Apply, on foolscap, giving fullest particulars of experience since leaving school, with respective dates, also names of schools and night-schools attended, with schedule of studies and successes gained, copies of testimonials and references complete. Applicants must state definitely that they are single.—Address, 7439, The Engineer Office. 7439 A

DRAUGHTSMAN REQUIRED for Provincial Engineering Works specialising in Malting, Conveying and Seed Machinery. State salary and qualifications.—Address, 7435, The Engineer Office. 7435 A

DRAUGHTSMAN REQUIRED, with Experience in Refrigerating Machinery. State salary and qualifications.—Address, 7438, The Engineer Office. 7438 A

DRAUGHTSMAN, Experienced Mechanical, REQUIRED for Engineers in S.W. London. Permanent progressive position with good prospects for man 25-30 years. Only real live men with good education need apply. State age, experience, and salary.—Address, P4040, The Engineer Office. P4040 A

DRAUGHTSMAN WANTED, Who has Experience in Cams and Tools for Automatic Screw Machines. A liberal salary will be paid to suitable man.—Address, 7445, The Engineer Office. 7445 A

EXPERIENCED DRAUGHTSMEN REQUIRED for large works on North-East Coast. Applicants must be under 35 years of age, and possess a complete training in General Mechanical Engineering, comprising first-class workshop and D.O. experience. Previous experience of chemical works plant not essential. Salary according to qualifications, with every prospect of promotion for suitable men.—Replies to be addressed to SYNTHETIC AMMONIA and NITRATES, Ltd. (associated with Imperial Chemical Industries, Ltd.), Billingham, Stockton-on-Tees. 7448 A

EXPERIENCED DRAUGHTSMAN REQUIRED with knowledge of Steel-frame Buildings, for London area.—Address, stating age, experience and salary required, 7437, The Engineer Office. 7437 A

TOOL-ROOM FOREMAN for Large Works on Mass production; must have a thorough knowledge of the Making and Design of High-class Press Tools; preference given to one having held a similar position before. State experience and salary required.—Address, 7428, The Engineer Office. 7428 A

SITUATIONS WANTED

A.M.I.C.E., A.M.I. Mech. E. (37), with Railway locomotive works, D.O., running sheds, automobile, tramway, general mechanical and maintenance work, building and public works and some electrical and commercial experience, DESIRES CHANGE; accustomed to control of large staffs and acting on own initiative.—Address, P4034, The Engineer Office. P4034 B

A YOUNG ENGINEER, Having 5 Years' Mechanical works and 5 years' mechanical and general constructional office experience in the three branches, buying, estimating and detail drawing, DESIRES to FINISH TRAINING as a DRAUGHTSMAN with a FIRST-CLASS FIRM of Engineers at an exceptionally low salary; good theoretical knowledge, full of grit, diligent and a conscientious worker.—Address, making an appointment, P4047, The Engineer Office. P4047 B

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Public Works in Spain.

REFERENCE has previously been made in these columns to the vast programme which the Spanish Minister of Public Works, Count Guadalhorce, has presented to the National Assembly for the carrying out of undertakings of national importance at a cost of 3900 million pesetas. It is proposed to raise this formidable sum by loans guaranteed by the State. The programme is drawn up under five heads, the first of which provides for the improvement and equipment of thirty ports with the object of increasing the export trade and developing a coastal traffic and also facilitating trade with Morocco. The second part of the programme consists in carrying out hydraulic works, principally for the irrigation of territories that suffer from an insufficient rainfall. A large number of artificial lakes and reservoirs are to be constructed. A year or so ago such works were started in the basin of the Ebro, which receives more than one-half of the total amount of rain falling on the Peninsula. Several companies, such as the Canadiense and the Catalana, have endeavoured to make use of this water, with, however, only partial success. The Government hopes to distribute one-half of the total amount of water available, and to produce a considerable quantity of electrical energy from the river Ebro, which will be made navigable as far as Caspe. It is expected that 2¼ million acres of land will be irrigated. In the basin of the Segura it is hoped to produce electrical energy equivalent to about 100,000 horse-power and to irrigate 250,000 acres of land, while the river Segura will be rendered navigable as far as Murcia. The hydraulic resources of the Jucar, Guadalquivir, Tagus and Guadiana will also be utilised in the same manner. Another important work will be the afforestation of those parts of the country, such as the Castille plateau, in which the vast forests that formerly existed have long disappeared, leaving arid wastes. The task of preparing a programme for the construction of a network of roads for motor traffic has been entrusted to a committee appointed by the Government. At first it was intended to put in order the 350,000 miles of roads in Spain, but the cost of doing so was far too heavy to include this undertaking in a general scheme, and the Government has therefore decided to lay out a certain number of motor roads and to improve 4300 miles of existing roads. The motor roads from Madrid to Irun and Valencia have already been begun. The whole work will be carried out by the committee, which will be composed of representatives of the Spanish Automobile Club, of the various transport companies, and of the State. The revenue from taxes and contributions from local bodies, as well as any surplus that may be available from the State, will, it is expected, cover the cost of this undertaking in about ten years, and the work of improving the roads will then be continued progressively. The improvement of 4300 miles of roads and the construction of seventy-nine bridges will involve an expenditure of 200 million pesetas, and another 600 million pesetas will be spent upon the motor roads. Railway construction also figures largely in the programme. This part of the general scheme was really begun two years ago when arrangements were made for the provision of 2600 million pesetas, nearly one-half of which is already devoted to the building of new lines.

The Industrial Transference Board.

IT was announced in the House of Commons a month or so ago that the Government intended to appoint a new board to assist in the transference of workers from places in the country's industrial areas where employment was unavailable to them to places at home or overseas where it was available. This week it was officially intimated that the Minister of Labour has, with the approval of the Prime Minister, appointed Sir Warren Fisher, Sir John Cadman and Sir David Shackleton to act as the contemplated Industrial Transference Board. The Board's work will be particularly, but not exclusively, devoted to the transference of miners. Sir Warren Fisher is Permanent Secretary to the Treasury. Sir John Cadman is chairman of the Anglo-Persian Oil Company. Sir David Shackleton was formerly Chief Labour Adviser to the Government. The Board, therefore, is representative of the official, employing and labour sections.

Vibration of Buildings by Traffic.

A FEW years ago, it may be recalled, there was a minor epidemic of breakage in the gas mains laid below busy thoroughfares. At the time it was freely asserted, no doubt with considerable justification, that the mains which fractured had been laid at a time when the severity of modern road traffic had not been foreseen, and that the damage had been wrought by the heavy vibratory loads transmitted to the ground by such traffic. Recent events, particularly the collapse of several buildings in London during the summer of last year, directed public attention to another aspect of the possible damage that modern traffic conditions may cause, namely, the effect on buildings of the vibration transmitted to them from the ground. London would appear to be particularly open to any damage that may arise from this cause, for in many places its streets and buildings lie over ground which is far from being virgin soil and which in places is honeycombed by long-forgotten cellars, sewers and other cavities. Two aspects of the problem involved present themselves. In the first place, it is necessary to determine the nature and measure the magnitude of the traffic vibrations transmitted to buildings. This aspect of the subject, we learn, is now being studied at the National Physical Laboratory by means of delicate apparatus, including a smoked-plate recorder, which magnifies the vibrations finally to a thousand times their original amplitude. Tests on several public buildings have shown that the effect of passing traffic is dependent, not only upon the class of vehicle composing the traffic and the speed along the road, but upon the character of the road surface to a marked extent. In the second place, it is necessary to study the effect of vibrations on building materials. This aspect of the work is being studied by the Building Research Board at its Experimental Station, near Watford, and by Professor C. F. Jenkin at the University of Oxford. We gather that while the effect of vibration on the strength of steel has been fairly fully studied, little information has as yet been collected regarding the effect of vibration on such materials as stone, concrete and brick.

The Empire Airships.

OF the two 5,000,000 cubic foot airships now under construction in this country, one, the R 100, being built at Howden by the Airship Guarantee Company, is rapidly approaching completion, while the other, the R 101, being built at Cardington by the Air Ministry, is less far advanced. As certain illustrations and particulars published elsewhere in this issue will show, the Howden airship is essentially a commercial passenger and freight vessel. It is less certain what lines the Government airship will follow, but it will probably be found that she will emerge from her shed as a passenger vessel which can readily be adapted, if thought fit, to military ends. Active preparations are being made to conduct demonstration flights with the airships to India, Canada and South Africa. When these flights have been concluded, it is intended, subject to the Dominions showing sufficient interest, to establish regular commercial services between this country and Ottawa, Cairo, Aden, Karachi, Colombo, Perth, Melbourne, Wellington, Bathurst, Cape Town, and Durban. In the early part of last year a mission from the Air Ministry left this country to study the conditions and requirements for the establishment of such services. The mission has now returned after having visited Africa, Australia, New Zealand and India. It reports that great interest exists in the Dominions in the carrying out of the scheme, and from the observations which it made in the different countries, it has drawn up a scheme for the establishment of main and intermediate airship bases at selected sites. Preparations, too, have been made for creating along the routes the necessary meteorological services on the efficiency of which the success of the whole scheme would depend to a considerable extent. The natural commercial airship route between this country and Australia and New Zealand is regarded as that taking in Cairo, Karachi and Colombo. The West Coast of Africa route is, however, also of importance, and is not being overlooked. It is pointed out that the Spanish Zeppelin Company proposes to establish an airship base in the Canary Islands for its Transatlantic service, and that the neighbourhood of Bathurst may yet become an important point in the air highway to South America.

Proposed High-speed Atlantic Liners.

IN a Journal note in our issue of November 11th last, we outlined the proposal of the American Brown-Boveri Company and other United States shipping interests to build and operate a fleet of fast Atlantic liners, which would make the crossing from America to Europe in four days. Further progress has now been made with this scheme, and an investigation into berthing arrangements for the new vessels at Montauk Point, at the extreme end of Long Island, has recently been made. In order to build the necessary quays with embarkation and Customs facilities, it will be necessary to construct four breakwaters at a total cost of about a million pounds. The Transoceanic Corporation of the United States has also been formed to back the new liner scheme with an available capital, it is stated, of close upon ten million pounds. An application will be made to the United States Shipping Board and to Congress for a large loan for the construction of the ships and for the granting of a long-term mail-carrying contract. Some alterations have been made in the original plans, and the new scheme is understood to embrace the construction of six vessels, each of 35,000 tons gross, with a length of 900ft., a draught of 35ft., and accommodation for 800 passengers. The propelling machinery is still under consideration, but will probably be of the geared turbine type, with 400 lb. pressure boilers and a high degree of superheat. It is difficult to express any final opinion on the merits of the proposed liners until fuller information is available. The practicability of the scheme is generally recognised by British naval architects and marine engineers, but fears are expressed that such high speeds will mean some sacrifice in that comfort which is enjoyed in present-day Atlantic travel, and that the high fuel cost is likely to make the liners uneconomical in operation. We understand that aeroplanes carried on deck will be utilised further to shorten the voyage to one of three days' duration.

The Impending Retirement of Mr. T. M. Newell.

AT a meeting of the Mersey Docks and Harbour Board, which was held last week at Liverpool, reference was made to the impending retirement of Mr. T. M. Newell, M. Inst. C.E., the engineer-in-chief to the Board, which will take place at the end of June. Mr. Newell will not, however, altogether sever his connection with the Board, for he will be appointed to act as its consulting engineer. By the beginning of July the work on the Gladstone Docks, with the design of which Mr. Newell has been so closely identified, will be practically completed, as will be the new entrance lock at Birkenhead and the inner entrance between the Alfred Dock and the East Float. As the Committee will then review the general position, it is felt to be a suitable time to consider the question of a successor to Mr. Newell, who has held the office of engineer-in-chief since January, 1913, when he followed Mr. Anthony Lyster. Mr. Newell was born in Liverpool, and after completing his education in 1881 he joined the engineering department of the Dock Board as a pupil of the late Mr. George Fosbery Lyster, the father of Mr. Anthony Lyster. After serving eight or nine years with the Dock Board, he was, in 1889, appointed the chief assistant engineer of the Hull Dock Company, and ten years later he became chief engineer. When, at a later date, the Hull dock undertaking was absorbed by the North-Eastern Railway Company, Mr. Newell was appointed chief dock engineer for the railway company's docks at Hull, the Hartlepools and Middlesbrough, in which office he continued to serve until his appointment to Liverpool in 1913.

The Thomas Lowe Gray Lecture.

WHEN taking the chair at the first Thomas Lowe Gray Lecture at the Institution of Mechanical Engineers on Friday evening, January 6th—a summary of this lecture appears on another page—Sir Henry Fowler, the President of the Institution, made brief reference to the bequest which had led to the founding of this lectureship. In 1923 the sum of £2000 was bequeathed to the Institution by the late Mr. Thomas Lowe Gray, who had been a member for over forty years, and was connected with Lloyd's Survey. The terms of the bequest were unusually wide and generous, for they permitted the Council to use the money in any way it thought fit, provided that it was employed to further the progress of marine engineering. Part of the bequest had been utilised to assist the carrying out of the trials on marine oil engines, and the Council had also decided to establish a series of lectures dealing with marine engineering progress, of which the first was then to be given by Professor C. J. Hawkes, R.N. There was a large gathering of members and guests, and the lecture was listened to with close interest. The thanks of the Council and members to the lecturer were fittingly expressed by Dr. Hele Shaw, past-President, and Mr. Richard Allen, Vice-president, both of whom referred to the great and growing importance of the subject discussed by the lecturer.

Cables and Wireless Telegraphy.

IN a paragraph on this page in our issue of December 2nd, 1927, we drew attention to the admission made by Sir John Dennison Plender, at the annual meeting of the Western Telegraph Company, that the cable telegraph companies were beginning to feel the competition of the wireless telegraph services. Sir John remarked that the situation might undergo farther changes, and that in the interests of all concerned co-operation rather than competition should be established between the two services. Sir John is the chairman of the Eastern, the Eastern Extension and the Western Telegraph Companies, three bodies having an aggregate issued capital of more than 14 million pounds, and possessing reserve funds of upwards of 11 million pounds. In a statement issued this week, signed by Sir John, and by Lord Inverforth, chairman of the Marconi Company, it was announced that Sir William Plender, on behalf of the Eastern and Associated Telegraph Companies, and Sir Gilbert Garnsey, on behalf of Marconi's Wireless Telegraph Company, had been asked to co-operate with a view to submitting a joint report on a possible arrangement in the interests of the respective companies. The cable companies, with their strong financial reserves, would no doubt have been able to sustain a rate-cutting war against the wireless services. The step now announced should result in such a war being avoided, and has, it is believed, been taken at the instigation of the Government.

Aeronautics in 1927.

No. II.*

WE continue below our review of the principal activities—so far as they may be disclosed—of British aeronautical firms during the past year.

Boulton and Paul, Ltd.—The chief item of interest reported from the Norwich works of Boulton and Paul, Ltd., was the production of the "Sidestrand" machine, of which an illustration appears on page 46. This machine is a twin-engined medium-range day bomber carrying a crew of three, namely, a forward gunner, a pilot, and an after-gunner and bomber. It has a span of 72ft., a length of 41ft., and a height of 14ft. 10in. The main planes have an area of 965 square feet, and the gross weight of the machine is 8850 lb. The construction is of the "all-metal" type, in the detail design of which many improvements have been introduced, including a general use of forgings and light alloy die-castings in conjunction with the firm's patented closed joint tubing. Much attention has been paid to the form of the body. Apart from the necessary interruptions caused by the cockpits, &c., the body, both in plan and elevation, presents true Joukowsky streamlines. The aerofoil section is of a form developed by the firm's technical staff by the application of modern aerofoil theory. We are informed that the combination of the selected aerofoil form with the Boulton and Paul patented balanced controls provides an exceptional degree of manœuvrability, and enables the machine to be maintained in perfect control at altitudes well beyond the stalling angle. Apart from the construction of the "Sidestrand," the firm continued to be busily employed on the fabrication of the metal framework for H.M. Airship R 101, now under construction at Cardington. The development of new experimental aircraft was also undertaken.

The Bristol Aeroplane Company, Ltd.—Among the new types of machine produced by the Bristol Aeroplane Company, particular mention may be made of the Bristol 101, a high performance two-seater fighter. This machine, of which we give an illustration herewith, is equipped with a Jupiter VI. engine, and has a maximum speed of 140 miles an hour with a stalling speed of 60 miles an hour. It can climb to 10,000ft. in 9 minutes and to 20,000ft. in 30 minutes. Its service ceiling is 21,000ft., or 4 miles. The wing structure is entirely of metal, and the fuselage structure of spruce reinforced with plywood and steel plate fittings. The ailerons are of the Bristol-Frise pattern, and are claimed to give an improved rolling moment and a decreased yawing moment over the whole range of flying speeds. A petrol tank of 29 gallons capacity is mounted in each of the top wings, while a third tank, of 20 gallons capacity, is arranged at the top of the front fuselage structure, just behind the fireproof bulkhead which isolates the engine from the rest of the machine. Beneath the fuselage petrol tank is the oil tank, and below that tank there is mounted a self-regulating oil cooler, which keeps the oil flowing to the engine automatically at an even temperature. The engine is provided with a special exhaust ring and silencer. The total military load carried by the machine is about 396 lb. Included in that load are two ·303 Vickers guns mounted on either side of the fuselage and a Lewis gun on a Scarff ring fitted to the rear cockpit. Five double drums of ammunition for the Lewis gun and 1200 rounds for the Vickers guns are carried. The Vickers guns fire through the propeller, and are fitted with the C.C. interrupter gear. In addition to this equipment provision is made for the carriage of two parachutes, a Verey pistol and cartridges and oxygen apparatus.

Another interesting Bristol machine produced during the year is the "Bulldog" high performance single-seater fighter. We illustrate this machine on page 46, but, unfortunately, we are not permitted to say much about it at present. It can be stated, however, that it is an all-metal machine, the principal members being of high tensile steel with certain subsidiary features of duralumin. The steel structure makes use of rolled sections in accordance with the usual Bristol practice, and is claimed to combine great strength with exceptional lightness. The pilot has a very wide field of view. The flying qualities and general manœuvrability of the machine are, we are assured, exceptionally high.

An improved type of Bristol "Lucifer" school machine made its appearance during the year. The sturdiness, simplicity and interchangeability characteristic of the earlier design have been retained, but the general lines have been improved, with a resultant improvement of performance. The machine now has a top speed of 130 m.p.h. and an economical cruising speed of 100 m.p.h. Another Bristol machine for use at flying schools is the advanced training machine, a two-seater, fitted with a Jupiter engine and Bristol Frise balanced ailerons. Like other school machines, it is designed with close attention to maintenance expenses and to withstand rough handling.

On the engine side the company was kept working at high pressure chiefly to meet the demands for Jupiter engines received from all parts of the world. Additional plant had to be installed, and still more plant will shortly be at work in extensions now under construction. Three recent developments of the Jupiter engine are the Jupiter VII., VIII. and IX. All three are, like the parent design, of the nine-cylinder static radial air-cooled type, and have cylinders of 5¾in. bore by 7½in. stroke. The series VII. engine is fitted with a gear driven blower. At ground level the engine is throttled to run at 1535 r.p.m., and to develop 370 B.H.P. As the machine ascends the throttle is opened progressively. At 1200ft. the engine runs at 1775 r.p.m. and develops 440 B.H.P., and at 15,000 the maximum full throttle gives a speed of 1950 r.p.m., the engine then developing 460 B.H.P. The series VIII. and IX. engines are fitted with 2 to 1 speed reduction gearing between the crank shaft and the propeller. The series VIII. engine has a compression ratio of 6·3 to 1, and the series IX. a ratio of 5·3 to 1. The rated horse-powers are 455 and 490 respectively at the normal engine speed of 2000 r.p.m. In both cases the speed may be raised to 2200 r.p.m., with a corresponding increase of power.

The H. G. Hawker Engineering Company, Ltd.—During the year the Kingston-on-Thames works of the H. G. Hawker Engineering Company, Ltd., were engaged on the production of the "Woodcock" single-seater fighter and the "Horsley" day bomber, two designs produced some two years ago. The "Horsley" machine was adapted for coastal defence purposes and arranged to carry a torpedo in place of its load of bombs. We illustrate the machine herewith, as converted into a torpedo carrier. In this form, we learn, it has given excellent results, and is now being produced in quantity. Another interesting adaptation of the "Horsley" bomber was that undertaken to make it suitable for the long-distance flight towards India carried out by Flight-Lieuts. Carr and Gilman. The machine adapted for this flight is illustrated on page 46 under test at Brooklands. The alterations effected were chiefly confined to the interior of the machine, and consisted of making provision for the carriage of additional petrol and oil and of fitting sleeping and domestic accommodation for the pilot and navigator. No structural alterations were made except the fitting of an axle of increased strength. That fact reflects great credit on the original design, for as made ready for the India flight, the machine weighed nearly twice as much as the normal. The engine remained the same, namely, a Rolls-Royce "Condor" III., but provision was made for increasing the petrol carried from 230 to 1100 gallons, the oil from 19 to 60 gallons, and the water from 18 to 30 gallons. These three items, which in the original machine represented a total weight of 2116 lb., amounted in the adapted machine to 8600 lb. The material alterations and additions represented a further increase of 440 lb. All in, the fully-laden weight of the machine was increased from 7800 lb. to 14,200 lb. The petrol, weighing just under 3½ tons, was carried in seven tanks, three in the fuselage, two in the centre section, and one in each of the top wings. The centre section tanks were made of tinned steel, but the remainder were made of welded aluminium. Welded aluminium was also employed for the oil tank, and the extra water required was carried in two copper tanks. It is of interest to note that the petrol carried amounted to more than that contained in the larger size of oil tank vehicle seen in the streets of London. There was sufficient of it to run an average light car for 34,000 miles, while the oil carried would have lasted such a car for its life-time. The welded aluminium tanks, we are informed, gave complete satisfaction during the trials of the machine and throughout the flight. The actual distance covered without a stop was nearly 3400 miles, and for a few hours constituted a world's record, until it was surpassed by the American flyers Chamberlin and Levine in their flight from New York to within a hundred miles of Berlin, a distance of some 3900 miles. The machine was forced to come down in the Persian Gulf, short of its intended destination, Karachi, as a result of a minor defect. The attempt was repeated later in the year, but it ended at Martlesham Heath after a duration of only an hour. This failure was most instructive. It was argued beforehand that while it would be difficult to get the heavily laden Horsley off the ground into the air, it would be impossible to land it again without crashing until much of its petrol load had been consumed. When a defect developed soon after starting, Flight-Lieut. Carr decided to take the risk of landing with practically the full original weight on board. By his skilful handling the manœuvre was accomplished without hurt to the machine or to those which it carried.

In addition to the work we have described, the Hawker Company was engaged on the construction of several experimental machines embodying the Hawker patented system of metal construction. At the Royal Danish Dockyard, Copenhagen, a further squadron of Hawker "Danecock" machines illustrated a year ago was constructed.

William Beardmore and Co., Ltd.—We are not in a position to illustrate or describe at present the work done by the Aviation Department of Wm. Beardmore and Co., Ltd., at Dalmuir. It is, however, an open secret that included in it was the construction for the British Air Ministry of "the largest aeroplane ever built"—an all-metal monoplane fitted with three Rolls-Royce "Condor" engines. It may be recalled that a few years ago the firm acquired the manufacturing rights in this country of the Rohrbach system of metal construction. It has applied that system to the construction of some large all-metal monoplane flying boats driven by two Napier "Lion" engines.

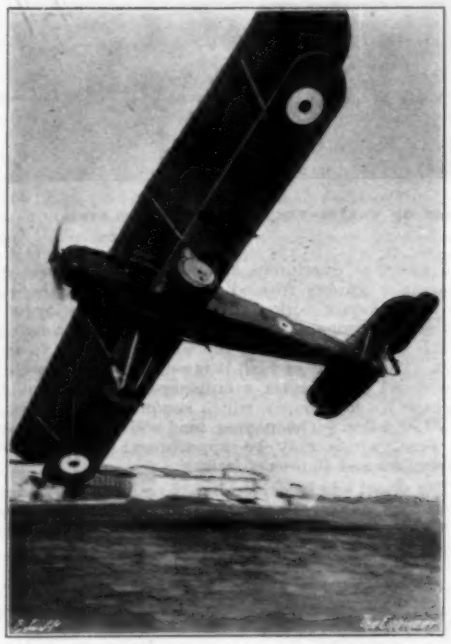
Armstrong, Whitworth Aircraft, Ltd.—Considerable

BRISTOL TYPE 101 TWO-SEATER FIGHTER

* No. I. appeared January 6th.

additions were made during the year to the workshops and to the number of workpeople employed by Sir W. G. Armstrong, Whitworth Aircraft, Ltd., at Coventry. The "Siskin" type of all-metal machine, which we illustrated a year ago, besides continuing to be made at Coventry, was produced under licence by a number of other firms. A considerable amount of research work was undertaken into problems connected with the production of steel aeroplanes, with the object of reducing the weight, increasing the strength and, if possible, cheapening the methods of manufacture. The three Armstrong Whitworth "Argosy" air liners which were built in 1926 for Imperial Airways, and which we illustrated a year ago, were recently stripped down for their annual airworthiness certificate. Their condition, we understand, was found to be extremely good.

Handley Page, Ltd.—Of the new machines produced during the year at the Cricklewood works of Handley Page, Ltd., we are not at present permitted to say anything. We regret the restriction less than we otherwise would because it frees us to devote our available space to an important—in the opinion of some, a most important—development of the Handley Page slotted wing system, which was brought recently to an advanced stage. The Handley Page slotted wing has been before the aeronautical world since 1920. In our issue of October 29th of that year we gave some account of its earliest form based on personal observation of two D.H. 9 machines, one with and one without slotted wings. It may be recalled that the early type of slotted wing consisted in effect of a normal wing section with a small "winglet" fixed in advance of its leading edge, the passage or

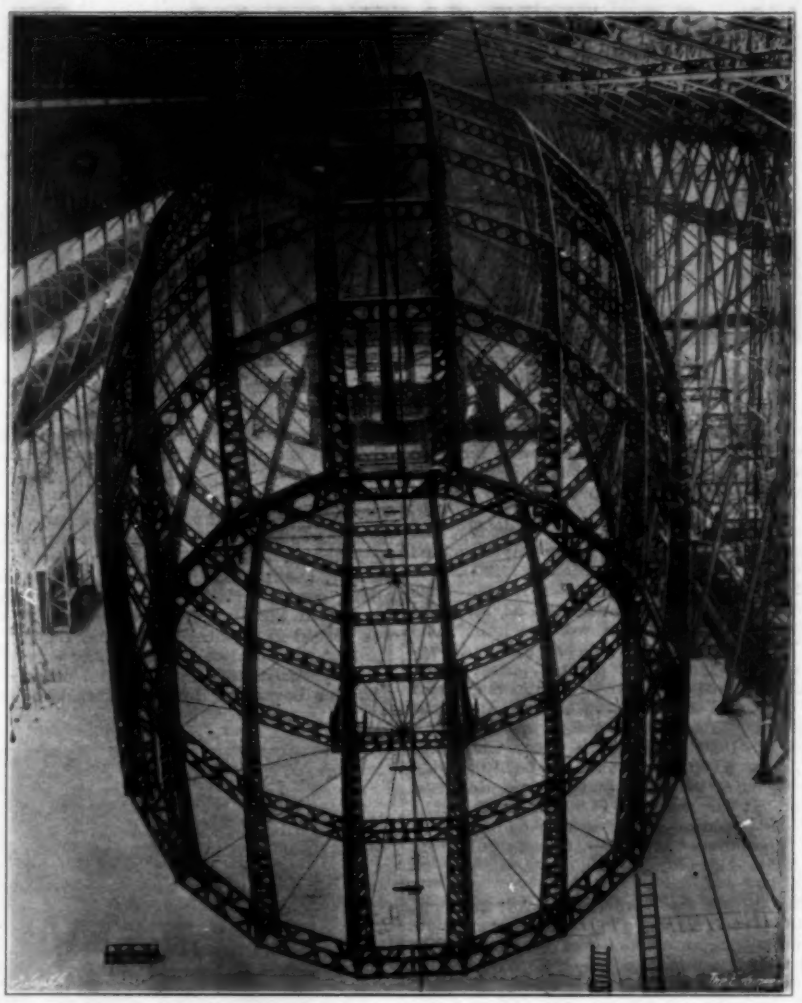


HAWKER HORSLEY TORPEDO CARRIER

slot between the rear surface of the winglet and the front edge of the wing being of diminishing width from the under to the upper surface. The characteristic feature of the arrangement was that the winglet was fixed so that the width of the slot could not be controlled in flight. In use, the chief property conferred on the aeroplane fitted with slotted wings was the ability to take off and land at steep angles, and consequently to get away from and alight within small spaces. The machine could, in effect, increase its lift by flying at an excessive angle of attack without entailing the increase of drag which in a normal machine made the attainment of such an angle of attack impracticable.

Three or four years later experiments were conducted on the effect of hinging the winglet, or at least a portion of it, and coupling it up to the aileron control in such a way that as the ailerons were operated the slot would open or close. It was found that the system provided a means of controlling an aeroplane when it was flying below the stalling speed. When an average normal aeroplane is stalled, the controls become weak or ineffective, with the result that the pilot is unable to check the spinning motion into which the stall usually develops. If his altitude is sufficient, he may recover from the stall or spin by allowing the machine to descend. If, however, he is too near the ground, a crash will occur before he can regain control of the machine. Many fatal stalls have occurred just after a machine has taken off or just before it landed.

When a machine is stalled and tries to roll over to one side in an incipient spin, the pilot endeavours to check the roll by lowering the aileron on the descending wing and raising the aileron on the ascending wing, the intention being to increase the lift on the descending wing and decrease the lift on the ascending. In general, because of the feebleness of the controls at the stalling angle, the ailerons will fail to react sufficiently, and the roll will develop almost unchecked. If the machine is fitted with slotted wings and if the winglets are connected to operate in conjunction with the ailerons, the slot is made to open if the aileron is depressed, and to close if it is raised. It is evident, therefore, that the duty which should be performed by the ailerons is transferred to the slots. The opening of the slot on the descending wing increases the lift of that wing and the closing of the slot on the ascending wing decreases the lift of that wing. As a result, the machine is brought back out of the incipient spin. It still remains stalled, but a stall without an incipient spin is a comparatively easy situation to get out of, even although the altitude is not great. So efficient is the slot-and-aileron control system that it is said to be difficult intentionally to spin a machine fitted with it. An intentional spin can, we understand, be made if the correct manœuvre for the purpose is understood. This point is of some importance, because it has been objected to the system that deliberate spinning is a useful fighting manœuvre. The evidence of the war, however, seems to suggest that to break off an engagement by spinning down is to invite the victory of one's adversary. In any event, the slot-and-aileron control does not affect ordinary aerobatic or fighting manœuvres, including the intentional spin.



AIRSHIP R 100 IN COURSE OF ERECTION

At first considerable complication was incurred in achieving the interconnection between the slots and the ailerons, much of the complexity being caused by the fact that the connection was not required to become effective until the machine approached within a certain range of the stalled condition. As the system has now been developed, the winglets are loosely pivoted or hinged to the wing in such a way that the slots automatically remain closed by reason of the pressure against them—and therefore do not operate in conjunction with the ailerons—until the speed of the machine falls to, say, 10 miles an hour above the stalling speed. At that speed the pressure and suction on the surfaces of the winglets results in the slots opening automatically, and thereafter remaining under the control of the connection with the ailerons until the machine is once again taken out of the region of the stalling speed. Constructional details of the automatic slot-and-aileron control system are not yet publicly available.

The De Havilland Aircraft Company, Ltd.—Three new types of machine were designed and built during the year at the Edgware works of the de Havilland Aircraft Company, Ltd. The first of these machines, known as the "Hound," was a two-seater military aeroplane fitted with a new type of Napier "Lion" engine. It is claimed that the performance of this machine is superior to that of any other military two-seater in the world. The second machine was the "Tiger Moth." It was built purely for research purposes, and was fitted with the first 32–130 H.P. de Havilland racing engine, an engine built at the company's works during the year to the designs of Captain Geoffrey de Havilland and Major F. B. Halford. During August this machine obtained the speed record for light aeroplanes Class III., achieving a speed of 186·47 miles an hour over a 100-kilom. course. Five days later it was given a trial climb, and reached an altitude of 19,191ft. in 17 min. The third machine produced was the D.H. 61, a six–eight passenger commercial aeroplane, intended for service in Australia. Its flight trials have just been concluded. The machine has a speed range of 47 to 127 m.p.h., can carry a paying load of 1900 lb., and has a range of 450 miles.

On the production side, it should be noted that the fourth and fifth Hercules machines for the Cairo-Karachi service joined the earlier machines during February. The five machines during the year gave a service of 100 per cent. reliability, except for the fact that just at the end of 1927 one of the machines was prevented by a violent gale from reaching its destination until it had been re-fuelled. A branch of the company was established during the year in Australia. Great progress was made in the popularisation and sale of the light aeroplane, known as the "Moth," and some notable performances were achieved with it, including a flight from London to Karachi, a distance of 5541 miles, a flight from London to Cape Town, and the winning of the King's Cup Race. Many Moth machines were sent to various countries overseas, and a licence to manufacture the type was granted to a German firm.

A. V. Roe and Co., Ltd.—The two-seater light aeroplane known as the Avro "Avian" was built in considerable numbers during the year. In the latest Mark III. form illustrated on page 46 several improvements have been introduced, among which is to be noted the "split axle" undercarriage, a feature which, it is claimed, by reason of the wide track, the strength, and the resilience which it gives ensures safer landings and makes "taxying" easier. Another improvement consists in an arrangement whereby, when the wings are folded, the landing wheels automatically move backwards. The folding of the wings, as a consequence, does not throw additional weight on the tail skid, and one person can lift the tail and move the machine easily. The Avro land and seaplane training machines and the Avro Gosport land machine were made in quantities during the year, but only minor modifications were made in their design. A con-

siderable amount of activity prevailed at the firm's experimental works at Hamble, Southampton. Included in it was the construction of the "Buffalo" deck-landing torpedo carrier, which will be found illustrated on page 46. This machine is driven by a Napier "Lion" engine and has a wing structure very similar to that of the firm's "Bison" machine, a fleet-spotter produced in 1925. The wings are arranged to fold to a maximum width of 17ft. The machine carries a pilot and a gunner. The fuselage is so designed that the gunner can also act as a bomber and can transmit and receive wireless messages. Experiments were also carried out with "Autogiros." Two of these machines were built for the Cierva Company. One of the engravings on page 46 illustrates the latest development of this class of aircraft.

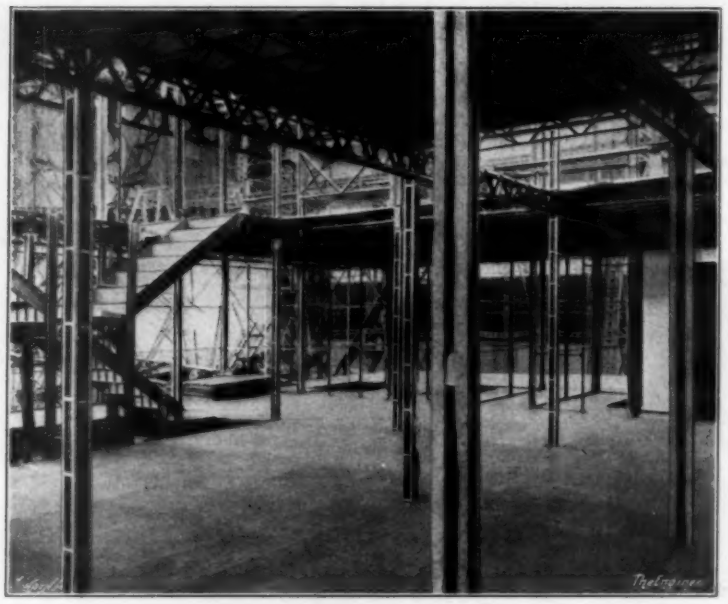
The Blackburn Aeroplane and Motor Company, Ltd.—Last year we illustrated the large triple-engined flying boat "Iris I.," produced by the Blackburn Aeroplane and Motor Company, Ltd., of Leeds. This machine during 1927 was made with an all-metal hull, in place of the original wooden hull. The "Iris II.," as it is called, is, like its progenitor, a long-distance reconnaissance and coastal patrol craft. It is driven by three Rolls-Royce Condor engines of 650 H.P., each, and carries a crew of five. Its armament consists of three machine guns, together with a bomb load of 1040 lb. With a gross weight of 27,000 lb., it has a top speed at sea level of 103 knots, a cruising speed of 80 knots, and a minimum speed of 50 knots. It can climb to 14,900ft., at an initial rate of 400ft. per minute, and has an endurance of ten hours. In appearance it differs immaterially from the "Iris I.," and accordingly it is unnecessary for us to illustrate it.

The "Ripon" torpedo plane, which will be found illustrated on page 46 was mentioned in our review twelve months ago, but on that occasion we were not permitted to say anything about it or to reproduce a photograph of it. It is a two-seater, and has been built both as a land machine and as a seaplane, the wheel and float chassis being interchangeable. In addition to being used as a torpedo carrier, it can be employed in either form as a bomber or reconnaissance machine. Its armament consists of an 18in. torpedo weighing 1500 lb.—or an equivalent load of bombs—and a Lewis machine gun operated by the observer in the rear cockpit. The two forms present an interesting contrast, for the comparative data covering their dimensions and performances reveal the extent of the sacrifice which has to be made if a machine has to be endowed with the ability to alight on water.

Ripon Torpedo Plane.
Napier "Lion" 450 H.P. Engine.

	Land machine.	Seaplane.
Span	45ft. 7in.	45ft. 7in.
Length	37ft.	40ft.
Height	13ft. 2in.	17ft. 2in.
Weight, empty	3842 lb.	4438 lb.
Weight, gross	7568 lb.	7664 lb.
Top speed, sea level	97 knots	92 knots
Top speed, 10,000ft.	85 knots	80 knots
Cruising speed	90 knots	85 knots
Minimum flying speed	40 knots	42 knots
Ceiling, absolute	11,250ft.	8,750ft.
Ceiling, service	9,700ft.	7,250ft.
Climb from sea level	620ft./min.	460ft./min.
Endurance	5 hours	5 hours

During the year the firm produced its well-known "Bluebird" light aeroplane in a new form. The principal modification as compared with the original design brought out in 1924, lies in the fitting of the machine with an engine of increased power—an Armstrong-Siddeley "Genet" of 65 H.P. The machine retains the characteristic seating arrangement of the earlier design. In all other British light aeroplanes the pilot and passenger sit in tandem. In the Bluebird they sit side by side, an arrangement which promotes the ease with which dual control can be installed, which possesses several structural advantages, and which does not entail serious aerodynamic disadvantages. The machine has a normal load capacity of 420 lb., and can fly for four hours at 75 miles an hour. The land undercarriage can be readily replaced by a pair of duralumin floats, thereby converting the machine into a light seaplane. We illustrate it on page 46 in this form.

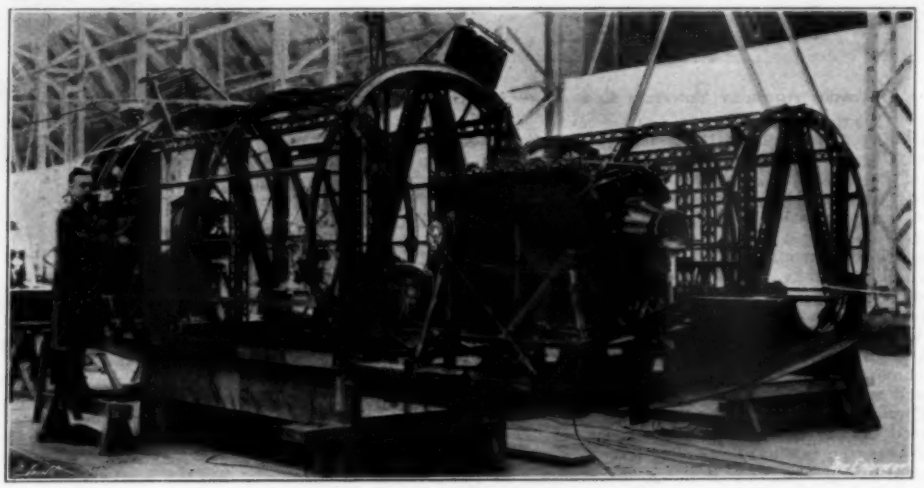


R 100—RESTAURANT FLOOR OF PASSENGERS' QUARTERS

R 100—THE FIRST OF THE FIFTEEN GAS BAGS INFLATED

Airships.

Towards the end of the year some particulars became available of the progress being made with the construction of the airship R 100, which is being built by the Airship Guarantee Company—an undertaking associated with Vickers Ltd.—under a contract with the British Government. The contract was placed in October, 1924, and during 1925 and the first part of 1926 the company carried out preliminary design and experimental work. Construction was begun at Howden, Yorkshire, in August, 1926, but the industrial troubles of that year caused considerable delay, with the result that the vessel is not expected to be completed until April this year. We illustrate herewith recent stages reached in the construction of the hull framework, and, in addition, give a view showing one of the engine cars partially completed.



R 100—ONE OF THE THREE ENGINE CARS

The airship has a length of 709ft., a maximum diameter of 130ft., and a gas capacity of 5,000,000 cubic feet. Her actual displacement will be 156 tons, and she will provide accommodation for 100 passengers and a crew of 35. She has been designed for a speed of 82 miles an hour. The passengers will be accommodated in two and four-berth cabins, and there will be a restaurant to seat fifty persons at a time. In order to reduce head resistance, the passenger accommodation will be arranged entirely within the envelope, except for a promenade deck, having a maximum width of 14ft., projecting from each side of the hull. In the general view of the structure given herewith. there is to be seen the beginning of the erection of the framework for the passenger's "house" within the hull towards the nose end. This house will have three "storeys," of which one, that devoted to the restaurant, is shown in one of our engravings.

The hull is proportioned on stouter lines than some earlier airships, the ratio of the length to the diameter being 5·3 to 1 as compared with 8·5 to 1 in certain Zeppelin airships. The members of the hull structure are made of duralumin and, in general, consist of triangular girders formed of three tubular booms united by lattice work. The net lift available for fuel, ballast, passengers, crew and freight is 73 tons, of which 30 tons represents the weight allotted to the fuel. This weight of fuel, it is estimated, will enable the vessel to maintain a cruising speed of 75 miles an hour for fifty hours, which is equivalent to a trip of 3750 miles. The paying load will be just under 25 tons, which may be apportioned between 100 passengers and 10 tons of freight.

The vessel will be driven by six engines disposed in three cars, one on the centre line towards the tail end and two outboard wing cars a little aft of the centre of the hull. It will be gathered from our illustration that each car will contain two engines, one driving a tractor screw and the other a propeller. As at present arranged, the engines will be of Rolls-Royce design. They will run on petrol and will develop 700 horse-power each. Subsequently, these engines, it is intended, will be replaced by light Diesel-type engines, using heavy oil fuel. These engines have not as yet passed the trials required to secure for them an airworthiness certificate.

Information concerning the progress being made with the construction of the airship R 101 at Cardington, a vessel of almost the same size as the R 100, is being witheld for the present by the Air Ministry. It is known that in their detail design the two airships will differ materially. The Ministry's vessel, for instance, is being built almost entirely of steel

instead of duralumin, and in this connection we note that during the year the fabrication of the steel framework members was brought towards completion by Boulton and Paul, Ltd., of Norwich, to whom the work was entrusted. It would appear that the R 101 is not in so advanced a stage of construction as the Howden airship, a fact which the large amount of preliminary research and other work carried out at Cardington, simultaneously with the designing of the vessel, in some way explain.

The handling of these huge craft presents many problems. It is officially estimated that at the first "launching" of one of them a handling party of 400 men will be required. Presumably a similar number will be needed each time the airship is returned to or taken from its shed. In the normal course of operation, however, the vessels will "berth" at mooring towers. The mooring tower erected for the purpose at Cardington was fully described and illustrated in our issues of March 11th and 18th. By its means a staff of a dozen men is sufficient to moor an airship. A similar mooring mast has been erected at Ismailia, Egypt, and preparations are in hand for erecting another at Karachi, India, and for one in Canada, while sites have been surveyed for others in Africa and Australia.

Railways in 1927.

As the opinion generally prevails that Great Britain has been provided with all the railways it needs, it will come as a surprise to many to learn that each year there is spent by the four grouped companies about 2000 or 3000 millions sterling out of capital on new works. Those sums, moreover, are independent of the cost of providing rolling stock and exclude docks, steamers, hotels, &c. They are independent, too, of the large amounts paid out of revenue for replacements consequent upon disturbance by new works.

To illustrate this point we may mention that at the opening of the year 1926 the four companies announced in their respective annual reports for 1925, that they proposed to spend 3020 millions sterling on capital works. The general strike and coal stoppage and the disorganisation of trade consequent thereon made the companies restrain this expenditure, and only 2012 millions were spent. A year later it was intimated that during 1927 it was proposed to spend 4421 millions, as follows:—London, Midland and Scottish, 1439 millions; London and North-Eastern, 948 millions; Great Western, 427 millions; and Southern, 1607 millions. How much of this vast sum was expended is not yet publicly known, and will not be revealed until the yearly reports are published next month—February.

Of the principal new works in hand during the past year we are now enabled, by the continued personal courtesy of the respective chief engineers, to make the following report:—

London, Midland and Scottish.

A new circular engine shed is being built at Willesden, which will have twenty-three engine roads, served by a 70ft. turntable. Outside the shed there will be two additional engine pits, each 65ft. long, mechanical coaling equipment and two double ash-lifting plants. The main walls of the engine shed are well in hand, and the steel work is being erected. To allow fast trains to overtake and pass slow trains, six cross-over junctions have been provided between Harrow and Wolverton, thus permitting greater use to be made of the four lines of way up to Roade, 60 miles from Euston.

Of the 15¼ miles between Crewe and Weaver Junction—where the Liverpool line leaves the main line to the North—2¼ miles were converted from two to four lines of way in 1910. The 4¼ miles between Coppenhall Old Junction and Winsford and the 2 miles between Hartford Junction and Acton Bridge were similarly widened last year. The work necessitated the removal of about 113,000 cubic yards of excavation, the widening of eighteen bridges and alterations and additions to two stations.

The station at Tilbury is being remodelled as indicated in our Annual Article a year ago, and a deep-water landing stage provided by the Port of London Authority. The portion of the circulating area at the east end and the approach road thereto were finished, and some of the decking at the west end, which is to carry the new baggage hall, was completed.

Two colliery lines are being constructed in Nottinghamshire. For the Clipstone Colliery there is to be, off the Mansfield and Southwell line, a branch 3 miles 2 chains long and another of 38 chains in length. About 237,000 cubic yards of excavation, the laying of 10,000 yards of permanent way, and the erection of six bridges, are involved. Nearly 65,000 cubic yards of the excavation have been removed. The other colliery line is off the Mansfield and Worksop line to the new Welbeck Colliery. It will be 3¼ miles in length and its construction will necessitate the removal of 140,000 cubic yards of excavation, of which about 29,000 cubic yards have been removed. There will be five bridges, the work upon which was begun. In Derbyshire very extensive alterations are being made at Staveley. There is to be a North Curve, ¼ mile in length, from the main line to Hall-lane Junction; the line thence to Seymour Junction, 1⅞ miles, is to be converted from single to double track, and additional siding accommodation at the last-named place, and a new up marshalling depôt at Staveley South Sidings are to be provided. The work involved includes about 120,000 cubic yards of excavation, the laying of nearly 12 miles of permanent way, the building of or alteration to eight bridges, including three footbridges, and a new station at Staveley Town. The excavation for the new curve is approaching completion, and about one half of the doubling has been done.

The additional reception and sorting sidings at Carlton—between Cudworth and Royston—have called for 225,000 cubic yards of filling, the laying of about 5 miles of permanent way, some bridge work, and the provision of a 70ft. engine turntable and engine pits. The greater portion of the sidings were brought into use during the year and the turntable is in hand.

The Chevet Junction and Snydale Junction Widening covers a length of 3¾ miles and involves the opening out of Chevet Tunnel, 702 yards long and 95ft. deep. The completion of the latter work and the opening of about 1¼ miles of the widening were mentioned herein a year ago. The northern portion of the work is now in hand. It involves 150,000 cubic yards of excavation and the widening of nine bridges. The earthwork was practically completed before the end of the year; a section of the additional up goods line is receiving its permanent way, and only two bridges remain to be finished. Associated with this work, but of subsequent development, is a curve from Oakenshaw—a point between Chevet and Snydale—on to the former Lancashire and Yorkshire line at Crofton, which is to give better access to and from Goole, Hull, &c. About 32,000 yards of earthwork require removal, and the work made good progress.

The Horbury and Wakefield Widening is 3¼ miles in length. It involves the opening out of Horbury Tunnel, the reconstruction of two bridges, the widening of twelve, and the provision of a new intermediate station. The tunnel has been opened out, and four lines of way were brought into use from Horbury to the new station and an additional down line thence to Wakefield. The joining up of the Victoria and Exchange stations, Manchester, made progress. The fish traffic was removed to Oldham-road goods station, the space between the viaducts over Chapel-street and Spaw-street was covered in with a view to putting in cross-over junctions between the former London and North-Western and the former Lancashire and Yorkshire lines. The platforms at Exchange Station were lengthened, the main roof at the west end of Victoria Station was extended and the booking-office remodelled. The widening of the bridge over the river Irwell to allow the platforms of the two stations to be continuous, and thus to be the longest in this country, approached completion. The contract for the power signalling was let.

On the Birmingham and Bristol line there is the Longbridge and Barnt Green Widening, 2¼ miles in length, which includes the opening out of Cofton Tunnel, 440 yards long and 80ft. deep. About four-fifths of the earthwork has been done. Altogether, more than 500,000 cubic yards of excavation are involved. In addition, five bridges have to be widened. Work on them was begun.

On many parts of the system the under-bridges need strengthening to carry the greater loading of the present day, and some of them were dealt with during the year. The timber viaduct across Butterley reservoir is being replaced by embankment and about 13,000 out of the 36,000 cubic yards of stone required have been deposited.

London and North-Eastern.

The branch, 1¾ miles long, with north and south curves, off the Firbeck Colliery branch of the South Yorkshire Joint Committee to Harworth Colliery, was nearly finished. The construction of a branch from the existing Harworth Colliery branch to connect up with that of the Joint Committee, was begun, and it is hoped that both will be finished simultaneously. Of the two new colliery lines in the Dukeries, the Bilsthorpe, 3 miles 10 chains long, and the Blidworth, 2 miles 13 chains, will be completed at an early date.

At Frodingham, where extensive changes are being made to deal with the ironstone traffic, the new western curve and the marshalling yard with twenty sidings to accommodate 2000 wagons, were half completed, and the building of the new passenger station made good progress. The works in connection with the new marshalling yard for up traffic on the up side of the line at Whitemoor, March, is far advanced. It will contain ten reception roads, each accommodating trains of eighty wagons. The wagons will be hump-shunted into forty sorting sidings, having a total capacity of 3679 wagons. Arrangements are being made to equip the sidings with mechanical "retarders" for regulating, by braking action on the wagon wheels, the speed of the wagons entering the marshalling sidings, thereby avoiding the employment of special yard brakesmen on this work. A mechanical coaling plant has been provided at the engine shed.

On the Manchester main line the goods loop on the up side between Hadfield and Dinting was opened. A contract was let to open up the two Hattersley tunnels, 100 and 264 yards long respectively, and separated by an opening of 110 yards, between Mottram and Godley. Provision will be made in removing the earthwork to enable the line to be widened later to four instead of two lines of way, and about 700,000 cubic yards of earthwork will have to be dealt with.

A second oil jetty of timber construction, 1900ft. long, provided with a tee head 330ft. long, having a depth alongside of 30ft. at L.W.O.S.T., is nearing completion at Salt End, Hull.

Two of the timber gates of the entrance lock to Alexandra Dock, Hull, were replaced by steel gates, designed to obviate the use of rollers. The hollow quoins were re-dressed and new pintles provided, by the use of caissons. The outer gates of Immingham Dock lock were removed and towed to Hull, where certain alterations are being carried out to them at the company's dockyard. On their replacement, the middle and inner gates will be dealt with in a similar manner.

No. 28 warehouse at William Wright dock, Hull, was rebuilt after a fire which left only the ruins of the outer walls standing. The old building was a heavily built brick structure, five storeys high; the new is two storeys high, covers the same area as the old, and is a steel-framed building. The first floor gives an uninterrupted space of 550ft. by 50ft. At Benton Hall, on the main line between Newcastle and Berwick, a steel lattice girder bridge of 144ft. span was constructed to carry the railway over a new road between Newcastle and the coast.

Great Western.

The goods station at Paddington is being completely modernised, and a year ago we reported the completion of the first section. The work involves the making of additional platforms, cellarage, new goods shed roof, and a rearrangement of the roads. The contract for the second portion was let at the beginning of the year and its first stage is approaching completion. The independent up and down lines between Paddington and Old Oak Common, reserved for the sole use of engines passing to and from the shed at the latter place and of empty carriages to and from the carriage sheds there, were brought into use in time for the summer traffic. The existing goods shed at Temple Meads, Bristol, is being reconstructed and enlarged, and, when completed, will cover an area of about 6 acres and have eight platforms, of a total length of nearly 2 miles, holding more than 400 wagons. The work is now three-quarters completed and it is hoped to finish it this year.

A down loop line has been provided between Whiteball Tunnel and Burlescombe. The reconstruction and enlargement of Newton Abbot Station was completed in time for the summer traffic. The accommodation includes two island platforms and a bay line on the up side at the east end. The Hoodown Viaduct, near Kingswear, was a timber structure carrying only a single line. It has now been replaced by a double line structure in concrete and steelwork, which not only assists the traffic operations by the elimination of the single line section, but allows bigger engines to work the Torquay expresses from Paddington throughout. Of the eight viaducts built by Brunel on the Falmouth branch, three—Penwithers, Pascoe and Penryn—have during recent years been replaced by embankment; work on the first named was finished last year. The past year also saw the completion of the substitution of a double-line masonry structure for the timber viaduct at Perran, which crosses a stream and valley and has three spans of 64ft. each. Another of Brunel's masterpieces—the Royal Albert Bridge, Saltash—also received attention. Of the seventeen approach spans, fifteen need reconstruction and the work is in hand.

Further progress with the reconstruction of the station at Newport, Mon., is reported. A new platform on the up side was brought into use, the island platform was extended and the station buildings opened. The platform covering was nearly finished. The new goods yard and warehouses at the same place are practically finished, and the yard is being re-arranged to suit. It is hoped to let the contract for the main buildings for the station and the district administrative offices in a few weeks. The provision of a large carriage shed at Ebbw Junction, which is consequent on the above-named work, is nearly finished. The enlargement of Queen-street Station, Cardiff, to allow of the Rhymney section trains using it and the reconstruction of Bute-road Station at Cardiff docks, are approaching completion. All the roads and platforms for the enlarged station at High-street, Swansea, were finished.

Southern.

Good progress was made during the year with the enlargement of the station at Wimbledon; some of the reconstructed platforms are now in use. Work was begun on the Wimbledon and Sutton new railway, 5 miles 20 chains in length, by the commencement of the embankments at the Wimbledon end. The work on the railway generally will shortly be started.

Southampton Town Station—the terminus of the original London and Southampton Railway—has

been undergoing reconstruction for some time and the work was almost completed during the year. The station buildings have been entirely modernised, the platforms lengthened and the track lay-out improved.

In the Isle of Wight the single-line section between Sandown and Brading has now been doubled. Among the bridge work consequent upon that alteration was a new bridge over the main road which required a maximum skew span of 58ft. 6in. A noteworthy feature of the widening was the variety of the geological strata encountered. It included chalk, clay of every colour—brown, bright red to dark blue—brick sand, sandstone, and even a small seam of what undoubtedly belonged to the coal family.

The three junctions at Tulse Hill are being rearranged so as to allow greater freedom for train movements. A commencement was made on the building of two new connecting lines at Lewisham, which will allow exchange goods traffic between the northern railways and Hither Green to avoid the crowded lines through London Bridge. The widening between Kent House and Beckenham Junction was begun. The local authorities asked that the headway of a certain overbridge be increased from 12ft. to 15ft. 9in. That desire, and an opportunity to improve the present gradient of 1 in 100, necessitated the main line being raised as much as 6ft. in some places.

The opening of the new lines, stations, &c., in the Margate and Ramsgate neighbourhood was mentioned in our Annual Article a year ago. Since then the new goods yard at Margate, on the site of the former Margate Sands branch, has been opened. At Ramsgate there is now a reinforced concrete engine shed, 250ft. by 100ft., and an electrically-operated coaling plant of 200 tons capacity.

The extensive alterations in connection with the rebuilding and enlargement of Dover Town Station have necessitated the demolition of Archcliffe Fort Tunnel. The major portion of the fort itself, which included five concrete gun emplacements, built in the Napoleonic era, has now been removed. The old timber viaduct between the fort and Shakespeare Tunnel is being filled in and a new sea wall and public promenade has been built.

In connection with the further electrification of the lines in the Central, or former Brighton, section, conductor rails have been laid on 142 track miles, out of the 240 miles to be done, and 175 track miles of running line have been bonded; 67 route miles, out of a total of 79 miles, of high-tension cable have been laid. The buildings of all the nine sub-stations were completed during the year, together with the extension of an existing one. The platforms at eleven stations have to be lengthened and that work has been done at nine. A new down platform at one station is in hand. A carriage cleaning and inspection shed at Selhurst is approaching completion. It is 600ft. long, 186ft. wide and holds twelve roads, with pits in each road. The carriage sidings at Victoria are being covered for a length of 750ft. and a width of 150ft. That work, too, will be finished early this year.

The strengthening of the bridges on the Eastern section, so as to allow for the boat trains to use any route, was practically completed. A contract was let for the reconstruction, in reinforced concrete, of the east pier of Newhaven Harbour, and the work was begun.

Sanitary Engineering in 1927.

Introduction.

No outstanding development or event in sewage disposal or sanitary engineering in general took place during the last twelve months. Both in this country and abroad, however, the adoption of one or other of the various forms of activated sludge treatment continued to increase, and it is stated that, at one sewage disposal works on the Continent, sewage containing from 85 to 90 per cent. of water is being used as feed for a small Brunler boiler, working with a submerged flame, and that the sludge is expelled from the bottom of the boiler in a state containing from 50 to 60 per cent. of water and at such a high temperature that, on being sent away on a moving band, it nearly dries itself by its own internal heat.

It is perhaps strange that, at this late date, there should still be some comparatively large towns in which pail-closets are, to a considerable extent employed, yet during the year several towns with by no means small populations applied for sanction to raise loans in order that conversion to water carriage might be carried out.

In our last annual article we stated that the Birmingham, Tame and Rea District Drainage Board was increasing its plant for obtaining power from gas given off during the treatment of sewage sludge. The original plant, which was installed by Mr. John D. Watson in 1921 at the Colehall Works of the Board comprised an engine of 34 brake horse-power. A couple of years or so ago Mr. Watson's successor, Mr. H. C. Whitehead, began an exhaustive examination of the subject, and as a result of his investigations decided to install a 150 B.H.P. engine working in conjunction with a series of 144 floating concrete gas collectors, each measuring 20ft. by 10ft. in plan, at the Board's Saltley Works. The collectors are coupled in three blocks of forty-eight each, and it is estimated that they will yield a total of 16,000,000 cubic feet of gas per annum with a calorific value of 625 B.Th.U. per cubic foot. The plant was put to work at the end of September last, and has been running daily at full load ever since. The estimated production cost of current is 0·49d. per unit, and it is stated that the installation of this first unit alone has effected a net saving at the rate of £1000 per annum in the cost of the power required at the works. The estimated cost of gas production, as given in a paper submitted for discussion by the Institution of Civil Engineers by Messrs. Vokes and Townend, is, on the basis of 16,000,000 cubic feet per annum from this unit, 7½d. per 1000 cubic feet of gas with a calorific value of 625 B.Th.U. per cubic foot.

Throughout the country a great many sanitary engineering works are being carried out and short notes regarding some of them are given below.

Works in Progress or in Contemplation.

In addition to those places which are separately mentioned in the succeeding paragraphs, the following, among many others, have either under way or in contemplation, sewerage or sewage disposal works of greater or less magnitude:—Aldershot, Ardwick-le-Street, Ashford, Bangor, Billericay, Chadderton, Chester, Coventry, Croydon, Derby, Dundee, East Grinstead, Eastry, Edinburgh, Epsom, Exeter, Feltham, Gelligaer—Glamorgan—Great Burstead—Essex—Harlescott, near Shrewsbury, Hartley-Wintney, Heysham, Hull, Ilkeston, Keighley, Kirby-in-Ashfield, Leamington, Leatherhead, Leicester, Lichfield, Maidstone, Marlow, Marsden, Monkton-Coombe and Avon Valley, North Shields, Norwich, Paisley, Portadown, Rayleigh, Reigate, Renfrew, Repton, Richmond, Romford, Rothwell, Ruislip, Sedgley—Staffs—Sefton (Liverpool), Stafford, Stoke-on-Trent, the Stour Valley, Swansea, Teddington, Todmorden, Watford, Whitby, Windermere, Wolstanton, &c.

The works at some of these places are of considerable magnitude and importance. For instance, the total expenditure contemplated by Stoke-on-Trent amounts, we understand, to over £230,000, and the works proposed include the shifting of the site of the disposal works. Then, again, Edinburgh is said to contemplate an expenditure exceeding £100,000; while for the Wolstanton undertaking, but little less will be required. The cost of works in two of the places will be between £70,000 and £80,000; in four between £60,000 and £70,000; in five between £50,000 and £60,000; and in three between £40,000 and £50,000. The combined cost of the works to be carried out at the remainder of the places in our list is many hundreds of thousands of pounds, and it by no means represents the full amount that is at present being spent, or about to be spent, for there is a whole host of other places where works of less magnitude than we have taken as our minimum in preparing the list, as well as others where the operations are on a larger scale, are in progress or in contemplation. It can well be said, therefore, that the volume of work being carried out in various parts of the country is very considerable.

Among the large schemes which have not gone beyond submission to the Ministry of Health is that for dealing with the whole of the sewages from the Borough of Ilford and the Urban District of Barking at a new disposal works on a marsh site on the bank of the Thames. Tank effluent only is provided for, and the sludge will be barged to sea. The total cost, including the Barking Outfall Sewer, is estimated at £285,000.

London Main Drainage.

Apart from works of repair and minor improvements of the main drainage system, the only important works undertaken by the London County Council during the year 1927 was the continuation of the two sewers, the construction of which forms part of the comprehensive scheme of works for the relief of flooding adopted by the Council in 1919.

Lewisham Branch Sewer, Branch from Hither Green.—This sewer is being constructed for the relief from flooding of rapidly growing districts in the outlying portion of Lewisham. It is 5ft. in diameter and about 3000ft. long, and, owing to the nature of the ground disclosed by trial borings, is constructed in cast iron segments lined with concrete. For part of the length compressed air has been necessary. Rapid progress was made during the year, and the works should be completed before the end of the year 1928.

Extension of Streatham and Balham Storm Relief Sewer.—This is an extension of an existing sewer constructed in 1912, which is being made in order to collect storm water from a larger area. The new sewer is about 1200ft. long, and is being built of brickwork in tunnel, the dimensions being 5ft. by 3ft. 6in. The work is still in progress.

Birmingham.

River Rea Improvement.—A scheme was in course of preparation for submission to the City Council for the improvement of about 10 miles of the river Rea, draining an area of approximately 34 square miles in the city. It will involve the deepening and widening of practically the whole length of the river channel, which is at present part brick and concrete and part earthworks, the reconstruction of bridges, &c., and of main and branch sewers.

Perry Barr Sewerage.—Preliminary schemes were considered and were partly prepared in detail for the main sewerage of portions of Perry Barr, an area which has recently been added to the city, and which will officially become incorporated with it in April next.

North Handsworth Sewerage.—Preliminary schemes were also in course of preparation for the drainage of North Handsworth, and there are possibilities of the sewer being extended in that valley to drain a very large area in the Midlands.

The extent of these schemes may be judged from the fact that their estimated cost would probably amount to between three and four million pounds.

Blackpool.

An important new sewerage scheme is being carried out at Blackpool. It comprises the construction of nearly 5 miles of new main and storm relief sewers, together with the installation of new pumps, and it is intended, when fully developed, to serve the whole of the Borough south of Talbot-road. The principal works consist of (1) a storm overflow sewer, 33in. to 48in. diameter, from the Whitegate-drive district to Marton Mere, where it will discharge; (2) a new sewer, 30in. diameter, from Whitegate-drive to Queen Victoria-road; (3) a new sewer, 33in. to 42in. diameter, from Crossland-road to Rigby-road; (4) a new storm overflow sewer from Hawes Side-land, with a new pumping station and sea outfall at Harrowside; and (5) new pumping plant at the Manchester-square, Rigby-road, and Bloomfield-road pumping stations, to replace or supplement existing plant. The sewers are designed to deal with one-quarter inch of rainfall per hour, and the storm overflow sewers—which are protected by specially designed screening chambers from the entry of any solid or floating matter—are not to come into operation until the foul sewers are discharging approximately twelve times the dry-weather flow. A length of about 700 yards will be in tunnel, the remainder being in open trench work. The sub-soil is waterlogged in the southern portion of the Borough. The estimated cost of the scheme is about £119,000.

Bournemouth.

Bournemouth is engaged in carrying out what is known as the Northern Drainage Scheme, which is designed primarily to drain the Northern Districts of the Borough, though, in its approach to the sea, it will also effect a relief to the Eastern Area. The scheme comprises the laying of a foul sewer nearly 7 miles long, discharging into the sea, and of a surface water drain 3 miles long, discharging into the River Stour. The sewer for a distance of 4 miles runs by gravitation at a uniform gradient of 1 in 500, and consists of rock concrete egg-shaped tubes, ranging in size from 18in. by 27in. to 28in. by 42in., surrounded by concrete. At its termination a pumping station will be erected, where the sewage will be lifted 25ft. by means of two 8in. diameter electrically-driven horizontal Stereophagus pumps, capable of delivering 1000 gallons of crude sewage per minute. Provision has been made at this pumping station for the installation of further pumps when required. From the pumping station the sewage will continue its course through a 16in. rising main, which will discharge into a 42in. diameter rock concrete tube, in which it will flow for the remaining 3 miles by gravity at a gradient of 1 in 400, and will finally be discharged into the sea through a 42in. cast iron outfall, the outlet of which is 2000ft. out to sea and 46ft. below low water of ordinary spring tides. Penstocks are provided, both at the pumping station and in the Outfall Chamber. The total cost of the works, including pumping station and the sea outfall, will be £150,000.

Bradford.

The Esholt works, which have been under construction for a considerable number of years, were very nearly completed, the cost of construction up to the present time being £1,750,000 or thereabouts, exclusive of land. The last of the precipitation tanks were finished during the year and all forty tanks are now in operation. A sulphuric acid plant, which is to be capable of producing 8500 tons of 140° Tw. acid per annum, and which will supply about one-third of the requirements of the Department in acid, was proceeded with and will be brought into use early in the New Year. Some delay, owing to the sale of approximately 200,000 tons of coal during the recent coal strike, occurred on the filter site, but 25½ out of the final 60 acres of bacterial filters were practically reinstated and most of the area is in use. The works as a whole gave every satisfaction during their first year of continuous operation.

Brighton.

A contract was let to John Gill (Contractors), Ltd., of Westminster, to reconstruct and extend the sea outfall of the Brighton Intercepting and Outfall Sewers Board, at a cost of approximately £66,000. This work consists mainly of laying two lines of 5ft. diameter cast iron pipes, supplied by the Stanton Ironworks Company, Ltd., and constructing a sea

wall and masonry groynes. For about two-thirds of the length of the outfall, the pipes will be laid for half their diameter in chalk cutting and covered with concrete, and for the remaining length below L.W.M. they will be fixed on green heart piles and cast iron cradles and saddles. Under present conditions, the outfall sewer is tide-locked for about six hours during each tide. The old sewerage system is a combined one; it has been found necessary to install pumps to deal with the flow during the period of tide lock. A contract will shortly be prepared for the installation of these pumps, which will be capable of dealing with about three times the dry-weather flow.

Other works in the borough include the completion of a 5ft. 10in. by 4ft. 6in. egg-shaped brick and concrete sewer and a 27in. concrete pipe relief sewer. Schemes are being prepared for the sewerage of the extended Borough, which will cover approximately five times the original area; the majority of these schemes will be calculated on a partially separate basis, in view of the fact that pumping has now to be resorted to.

Camborne.

An interesting disposal undertaking was practically completed at Camborne during the year. The scheme, which owes its inception to Major John Chadwick, M. Inst. C.E., was worked out some fifteen years ago, and received the sanction of the Ministry of Health before the war. Work on it was not, however, begun until some time after the conclusion of hostilities. Its distinguishing feature is a tunnel through a cliff which at its highest point is some 300ft. above the excavation. The tunnel, which is concrete lined, is 3048ft. long and measures 7ft. wide by 5ft. high. It is laid with a gradient of 1 in 80. Arranged along one side of it is a line of egg-shaped sewage-carrying concrete pipes 2ft. 6in. high by 16in. at the widest part. Every 500ft. there is a manhole for inspection purposes. On the other side of the tunnel there is a pathway. Boring was carried out from both ends simultaneously, and the headings met with a deviation of less than 1in. When the sewage reaches the extremity of the concrete pipe line it drops through a manhole to a cast iron pipe 25ft. below, which affords an outfall at low water mark of spring tides. Some ten miles of sewers have also been laid throughout the district. The approximate cost of the undertaking has been £60,000.

Chatham and Rochester.

The year witnessed the completion of the main joint outfall sewer from Rochester and Chatham, about 5 miles in length, varying from a 30in. concrete sewer to a 5ft. by 3ft. 6in. concrete culvert, and for half its length in tunnel 200ft. deep and costing about £124,000. From the end of this culvert the sewage will be conducted over the marshes in iron pipes in syphon to the disposal works, which are now nearing completion and will have cost about £100,000. The sewage from 100,000 people can be dealt with there, and as the effluent is discharged into the tidal waters of the Medway estuary only tank treatment is being given. The settling tanks are of the Dortmund type, and the effluent goes straight to the Medway, whilst the sludge is dealt with on sludge beds before being deposited on the land. Provision is made of the usual storm-water tanks, but six times the dry weather flow is all that will be expected, as storm-water overflows are made to operate before delivering the sewage to the joint sewer. Altogether nearly 37 miles of internal sewers have been constructed in the borough of Chatham, costing nearly £225,000. A large pumping station for the low-level area, to deal with one-third of the sewage, is now being constructed, and the unscreened sewage from that area will be lifted into the joint main by "Unchokable" pumps.

Doncaster.

During the year Doncaster received sanction for loans for a total of just over £150,000 for the construction of (*a*) a main intercepting sewer to Low Pasture and the outfall works, including detritus tanks, a pumping station, storm-water tanks, &c.; (*b*) surface water drains to the River Don; and (*c*) a main intercepting sewer from Hyde Park to Low Pasture. The Borough also applied for sanction for loans to a total of over £77,500 for a rising main, pumping machinery and an extension of the Sandall purification works. The work carried out during the year included that in connection with the main outfall works, the erection of the pumping station, and the construction of storm-water tanks and sludge filters. The total amount of the loans sanctioned and applied for in respect of sewerage and sewage disposal works is £379,554.

Leeds.

During the year good progress was made with the Thorpe Stapleton sewage scheme of the Leeds Corporation. At the Low Level works the construction of the sewage feed channels, the storm-water separator bay, the precipitant storage tanks, &c., were completed, the cost being £33,000. The construction of another unit of precipitation tanks was begun, the estimated cost of the work being £54,000. At the High Level works the storm water and humus tank were completed. The capital expenditure incurred during the year, including the amount spent on sewers, was £118,657, and the total expenditure at the Thorpe Stapleton works, since the commencement in 1908, has been £1,994,858.

At the Corporation's Rodley works an extension was completed at a cost of £24,000.

Leicester.

In connection with the storm water and sewage Disposal Works which are in progress at Leicester, the extensions of the Abbey Pumping Station buildings were completed during the year, and three triple-ram pumps were fixed, two of which have been under load. The 44in. rising main was laid up to the Sewage Farm and tested. The new bacterial works on the farm were practically completed, with the exception of the media for the filling of the percolating filters. Two pumping stations have been erected, and the electrically-driven pumps have been fixed. It is expected that these works will come into operation early in the New Year. The electrification of the Beaumont Leys effluent pumping station was completed, and is working satisfactorily. The piping of the 12 acres of existing bacteria beds was also completed, and is proving satisfactory, and the building of the new sedimentation tanks at the end of the existing tanks was finished. The storm water tanks at the Abbey Pumping Station are nearing completion. The contract for the diversion of the main sewers, screening plant, detritus tanks, &c., is well in hand. Most of the sewers have been constructed, and the bulk of the excavation for the detritus tanks has been done. The contracts that have been let amount to well over £600,000 out of a total of £640,000.

Manchester.

Steady progress was made during the year with that portion of the extension scheme at the main outfall works which relates to the construction of additional detritus tanks, a screening chamber, new offices, laboratory, &c. For several reasons, however, chief among which were foundation difficulties, the works in connection with the new large-scale activated sludge units have not yet been begun.

The new main for conveying sludge from the Davyhulme works to land owned by the Corporation at Flixton and Carrington was put into commission towards the end of the year, and it is now possible to dispose of relatively large volumes of sludge by trenching on that land.

A considerable amount of research work relative to the economics of the activated sludge process was undertaken, and the problem of the disposal of the sludge by secondary fermentation, and the utilisation of the resultant gases, received, and is still receiving, a good deal of attention.

Main Drainage.—The sewer known as Work No. 5, the construction of which had been in progress since 1924, was completed in the early part of the year. The total length is about 4 miles, and the size varies from 12ft. diameter to 4ft. 9in. Owing to the nature of the ground—running sand—a large proportion of this work had to be constructed under compressed air in cast iron segments lined with brickwork and concrete. The Gorton relief sewer, which varies in size from 3ft. 9in. diameter to 12in. pipes, was completed early in the year, as also was the Withington and Didsbury intercepting sewer, 1½ miles long and varying from 4ft. 6in. diameter to 3ft. diameter and from 20ft. to 30ft. deep.

Davyhulme Sewage Works Extension.—The portion of the scheme connected with the preliminary treatment of the sewage was in progress throughout the year, and the new detritus tanks and screening chambers are now nearing completion. In addition, a pumping station was constructed, and a 9in. diameter cast iron sludge main laid for a distance of 2¼ miles from the works to the sludge disposal site near Flixton, so as to provide a method of disposing of the sludge alternative to the present system of sending it out to sea in a tank steamer.

Southend.

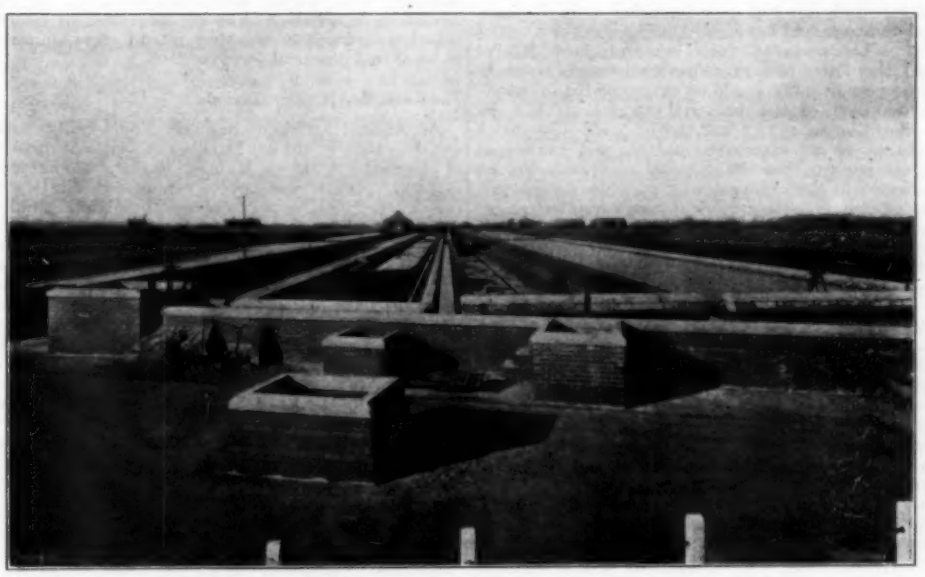
Southend is engaged on some important works, the cost of which, when completed, is estimated at £275,000. Acting on the advice of Mr. John D. Watson, M. Inst. C.E., of the firm of Dodd and Watson, of Birmingham, the Corporation promoted a Bill in Parliament during the 1926 session and obtained authority to discharge screened tank effluent, instead of the former bacteria bed effluent, into the estuary. The work now being undertaken involves (*a*) the construction of sedimentation tanks and screens at the existing sewage works at Prittlewell; (*b*) an outfall conduit, 5ft. in internal diameter; (*c*) a cast iron sea outfall, 5ft. in internal diameter; and (*d*) arrangements for dealing with the sludge on a newly acquired site. During the year the contract for the 60in. cast iron pipes was let to the Staveley Coal and Iron Company, Ltd., and the work of laying these pipes was the subject of another contract let to Howard Farrow, Ltd. The length of the outfall will be about 1½ miles from the beach to below low-water mark. Some of the pipes will be carried on piles. The work was started last October. Another contract for sinking five trial shafts to be used as working shafts for the tunnels has been let to Chandler Brothers, of Manchester. These trial shafts are on the line of the outfall conduit, and vary between 20ft. and 60ft. in depth. They will afford information of strata to be encountered during the construction of the 3-mile long effluent conduit, about 2 miles of which will be in tunnel.

Uxbridge.

The scheme for the drainage of the parishes of Ickenham, Hillingdon and Harefield, which is to cost about £95,000, was actively proceeded with during the year. The undertaking is in the area controlled by the Thames Conservancy, and comprises a sewage disposal works, with an outfall and branch sewers. The sewage will be pumped for settlement and purification treatment on bacterial filters, and the effluent will discharge into the Yeading Brook.

Wigan.

The Wigan Corporation completed the first section of the reconstruction and modernising of the town's sewage works from broad irrigation to the bacterial system of treatment at a cost of £102,685. The scheme when finally completed will provide for a dry-weather flow of 28 gallons per head for a population of 120,000, or a total of 3,360,000 gallons per day dry-weather flow of sewage to be treated at Hoscar. The storm water for three to six times the dry-weather flow is treated at Wigan, and after being screened passes to a large circular tank, from which it is pumped by means of a set of three direct-coupled electrically driven pumps into four reinforced concrete tanks having a capacity of 928,000 gallons. From these tanks it passes over the overflow cill and into the river Douglas. The sewage, after being led through a duplicate set of screening, raking, and dredging apparatus, passes through two Venturi meters and thence by means of two cast iron pipes to Hoscar, a distance of 7½ miles. At Hoscar it enters a covered-in receiving chamber, from which it passes to the bottom of a reinforced concrete preliminary



WIGAN'S HOSCAR SEWAGE DISPOSAL WORKS—SETTLING TANKS

settling tank which has a capacity of 77,500 gallons. It issues from the top of this tank through eight cast iron bends and flows to four settling tanks which have a capacity of 1,312,075 gallons. From the latter it is taken to two batteries of bacteria beds, each battery comprising eight 80ft. diameter and three 33ft. diameter automatically controlled distributors. These beds cover an area of 10,000 square yards. The effluent from the beds passes to a duplicate set of reinforced concrete humus tanks having a capacity of 320,000 gallons, and the final effluent flows over a glazed tile cill on to a glazed brick carrier floor and is then carried to the river Douglas, a distance of 900 yards. The sludge beds for the preliminary tank, the settling tanks, and the humus tanks have a combined area of nearly 27,500 square yards.

To complete the scheme there are still two batteries of bacteria beds to be constructed. Views of the

WIGAN'S HOSCAR SEWAGE DISPOSAL WORKS—BACTERIA BEDS

settling tanks and filter beds are given in the accompanying engravings. The whole work in connection with this undertaking has been carried out to the designs and specifications of Mr. R. B. Donald, M. Inst. C.E., the Borough and Water Engineer of Wigan.

Paris.

The French are still experimenting with the bacterial treatment of sewage. During the year works were in operation at Colombes and Port Marly. When the Paris sewage difficulty became acute it was supposed that it would be overcome by an extensive adoption of the bacterial treatment, but to lay down plants to deal with vast quantities of sewage is an expensive matter, and municipal finances require that the disposal of sewage should be effected in the cheapest way possible, compatible with efficiency. The problem was complicated by the necessity of bringing the suburbs within a general scheme of sanitation. The state of affairs in many of the suburbs is deplorable, and a scheme was therefore prepared providing for the disposal of a portion of the metropolitan sewage, as well as that from some of the suburbs, on a sewage farm which it was intended to lay out in the valley of the Seine, forming a continuation of the existing Achères farm. Conduits were to be put down from St. Ouen to La Frette, a distance of about 12 miles, and at the latter place a pumping plant was to be installed for sending the sewage to the farm on the other side of the river. The local opposition to that plan was so strong that it had to be abandoned, for the time being, at any rate. Then it was proposed to send the sewage as far as Champagne, in the hope that a part of the cost would be defrayed by the communes which would profit from that means of disposal. The possibility of carrying out such a scheme appears extremely dubious. The year was, therefore, practically lost so far as concerns Parisian sewage disposal developments, and the Municipal Council must find some more acceptable plan for dealing with quantities of sewage which are steadily increasing.

River Pollution.

The prevention of the pollution of rivers and streams was a good deal to the fore during the year. Much dissatisfaction was felt at the reception accorded by the Earl of Balfour, as Lord President of the Privy Council, to a joint deputation from the British Waterworks Association, the Society of Medical Officers of Health and various fishery organisations which waited upon him in February. The deputation sought for the appointment of a Central Committee representing the Government and various River Boards, with considerable powers, to control pollution. The proposal was refused for several reasons, which need not be enumerated here, but it was made quite evident, later in the year, that the Government had by no means shirked the question, but was, on the contrary, quite alive to the importance of the matter. The deputation's suggestion had entirely ignored the existence of the Ministry of Health and the Ministry of Agriculture and Fisheries, and had not even indicated how it was proposed that the Central Committee should work in conjunction with those bodies. The Government, however, solved the matter and took what, probably, was the best possible course in the circumstances. Late in the year, the Minister of Health, in conjunction with the Minister of Agriculture and Fisheries, appointed a joint advisory Committee to consider the whole question and to report from time to time what measures—legislative and otherwise—should be taken to reduce that pollution. The chairman of the Committee is Sir Horace Monro, K.C.B., and the other members are:—Mr. A. R. Atkey, Rear-Admiral T. Beamish, R.N., Messrs. H. E. Brooks, J. T. Conroy, S. Easten, C. N. Hooper, F. E. Warbrech Howell, L. Holme Lewis, M. Inst. C.E., and W. Prescott, Lieut.-Colonel D. Watts-Morgan, and Dr. H. Maclean Wilson. Of course, the mere appointment of a committee may mean little or nothing, but judging from the work of the two Ministries in question in other directions, it may be taken that, in this case, they intend the Committee to be of real practical service.

The Late Mr. Midgley Taylor.

An Annual Article on Sanitary Engineering during the year 1927 would not be complete without mention of the death of Mr. G. Midgley Taylor. No engineer of any period was ever connected, directly or indirectly, with more schemes involving sanitary engineering experience than was Mr. Taylor. There were comparatively few sewage disposal undertakings of any magnitude with which he, in one way or another, was not concerned, and he had also gained unrivalled distinction by reason of his skill in dealing with the intricate technical details which have always to be faced when a town or a city enlarges its area by taking in surrounding districts. The number of successful sewage disposal schemes—not to mention water supply works—which he himself devised and carried out was very large. His reputation as a technical witness before Parliamentary Committees was as high as his reputation as a constructional sanitary engineer. By his death the profession suffered a very severe loss.

The Marine Oil Engine.*

BEFORE the war sea experience with marine oil engines other than submarine engines was not very extensive. A small amount of experimental work was in progress in this country; and on the Continent experimental engines of up to 2000 B.H.P. per cylinder had been constructed for testing on shore. High-speed two-stroke cycle engines were being developed, and engines of this type were fitted in a number of submarines; but it cannot be said that they were successful.

There was considerable activity in the development of the marine oil engine on the Continent before it was seriously considered in this country, and before the war a number of British firms obtained licenses for the construction of oil engines of continental design. In the circumstances then ruling this policy may have been justified. During the war very few marine oil engines were constructed, with the exception of submarine engines, and there was little opportunity for development in this country. After the war there was a greater demand for marine oil engines, and I think it is to be regretted that so few British firms developed engines of their own designs, especially in view of the fact that knowledge of the subject had then been widely disseminated. It may be that initiative in the direction of independent development was influenced by the high cost of experimental work and the desire to produce engines for the market as soon as possible. There has been a distinct improvement in this respect within the last few years, and the number of firms having their own experimental engines has increased. It is true that the construction of experimental units is costly, but the need for experiment and research was never more important than it is to-day. A single-cylinder experimental engine not only enables one to get first-hand knowledge and experience of a new design, but the engine is always available for testing on shore any improvements in details or any modifications that may be found necessary as the result of experience at sea.

I will not attempt to make comparisons between ships propelled by steam engines and ships propelled by oil engines; this subject has been dealt with frequently within the last few years, and, moreover, much depends upon the assumptions made, particularly in regard to the relative costs of fuels. That the motor ship is to-day a serious competitor of the steamship is evident from the returns of Lloyd's Register of Shipping. We find that several motor ships have been completed with engines designed to develop about 1200 B.H.P. per cylinder, and the oil engine has entered the region of high powers which was formerly regarded as the province of the steam engine. The outstanding advantages of the steam turbine are that it can be readily designed to develop large powers and that it has no reciprocating parts. These advantages alone make it eminently suitable for special purposes. The steam turbine is less efficient than the oil engine, but recent developments have resulted in reducing the advantage held by the latter; for example, the oil consumption of the geared turbines fitted in the Empress of Australia is stated to be 0·69 lb. per S.H.P. hour for the main and auxiliary machinery, excluding deck services. The superheated steam was supplied by cylindrical boilers at a pressure of 220 lb. per square inch and the fuel used was "boiler oil," having a calorific value of 18,500 B.Th.U.'s. It must be admitted that this is a remarkable result.

It is probable that future developments may effect an increase in the efficiency of the large oil engine, but I do not think that much can be expected in this direction. The most efficient marine engine at the present time is the Still engine. The recorded fuel consumption of the Still airless-injection two-stroke engine, which was tested on shore by the Marine Oil Engine Trials Committee, was 0·353 lb. per B.H.P. hour for the full load trial No. 10, the fuel used having a calorific value of about 19,500 B.Th.U.'s The Doxford airless-injection opposed-piston engine was also tested on shore by the Committee, and the recorded fuel consumption was 0·416 lb. per B.H.P. hour for the full load trial No. 13, the fuel used in this case having a calorific value of 18,200 B.Th.U.'s. If we assume that the combustion in these engines can be improved so that the consumption per indicated horse-power is about the same as that of an efficient air-injection engine, after making an allowance for the effect of the blast air, then the indicated thermal efficiency on the combustion side would be about 43 per cent. With this efficiency, and with fuel having a calorific value of 19,500 B.Th.U.'s per pound, the fuel consumption per B.H.P. hour would be about 0·35 lb. for the Doxford engine, assuming a mechanical efficiency of 87 per cent., and about 0·32 lb. for the Still engine, with a mechanical efficiency of 90 per cent. I regard these estimated consumptions as the minimum possible at the present time.

Waste-heat boilers are fitted to a number of four-stroke marine engines at the present time with the object of recovering some of the heat from the exhaust gases, and increasing the overall efficiency of the installation. In the two-stroke engine, however, the exhaust temperatures are generally lower than in a comparable four-stroke engine, due to the effect of the scavenging air, and it is doubtful whether the production of steam would justify the fitting of waste-heat boilers in two-stroke installations, particularly in the case of efficient engines having a high volumetric efficiency, although such boilers might be useful as silencers and for supplying hot water for heating living spaces.

In a few instances high-speed oil engines have been fitted to drive the propeller shaft through hydraulic clutches and gearing. It is claimed that the arrangement has resulted in a reduction in the dimensions, weight, and cost of the installation as compared with the direct drive. The geared installation certainly has the advantage that cylinders of moderate diameter can be employed, but there would be no gain in fuel economy over the direct drive. So far as saving in first cost is concerned, the use of geared engines is, in my opinion, limited to moderate powers which

* From the first Thomas Lowe Gray Lecture. Delivered by Professor C. J. Hawkes, M.Sc., before the Institution of Mechanical Engineers on Friday, January 6th, 1928.

will admit of the employment of four-stroke trunk piston engines.

I think it will be agreed that trunk pistons are unsuitable for high-speed two-stroke engines; and if external crossheads are fitted, then, as in the case of the double-acting four-stroke engine, the weight of the reciprocating parts will be increased and the speed will have to be reduced for the same wear and tear factor as for the single-acting four-stroke trunk-piston engine. The scavenging efficiency of a high-speed two-stroke engine would be lower and the fuel consumption would be higher than with a low-speed two-stroke engine. It seems, therefore, that we cannot hope for any appreciable reduction in the first cost of a high-speed two-stroke single-acting geared installation as compared with that of a low-speed two-stroke single-acting engine with direct drive. The high-speed two-stroke double-acting engine has yet to be developed, but there is no indication that it is likely to prove less costly to construct when geared to a propeller shaft than a direct drive, and such an installation would certainly be more complicated.

When considering the slow-speed direct-coupled engine the question of type arises. The first motor ship of large size to be completed was the Selandia. This vessel was at sea early in 1912, so that she has now been in service for about sixteen years, and I understand that she is still giving satisfaction. The engines fitted in the Selandia, and all subsequent engines constructed by the engine builders, Messrs. Burmeister and Wain, of Copenhagen, and their licensees, are of the four-stroke type. Much has been said in the past concerning the best cycle of operation, and the advantages and disadvantages of the two-stroke and four-stroke engines are now fairly well known. There is undoubtedly more experience available with the four-stroke cycle, and in some respects it is an easier proposition than the two-stroke cycle. For moderate powers the single-acting four-stroke engine has much to recommend it, and it has proved satisfactory in service. For higher powers, where the single-acting engine no longer meets requirements, one has to turn to the double-acting four-stroke engine or to the two-stroke engine. Several double-acting engines are now at sea, and, according to published accounts, they are generally satisfactory; but, although I do not wish to detract in any way from the performances of these engines, for large powers and low speeds I prefer to look upon the single-acting two-stroke engine as the next step in development rather than the double-acting four-stroke engine.

For larger powers the double-acting two-stroke engine is the logical line of development, but I will not attempt to fix a limit of power above which it would be advisable to consider such engines instead of single-acting two-stroke engines, as, apart from questions of reliability and ease of overhaul, so much will depend upon the dimensions, weight and cost of the respective designs and the particular service for which they are intended. The introduction of the lower cylinder cover and the stuffing-box makes it a more complicated engine than the single-acting engine, but for large powers it has the undoubted advantage that the number of cylinders can be reduced; and it should eventually prove a cheaper engine to construct. A number of experimental double-acting two-stroke engines are now on the test-bed, and it is reasonable to expect that a reliable engine of this type will be produced. The real test of any engine is at sea, and I do not think that there is at the present time sufficient sea experience with the double-acting two-stroke engine to enable one to express a definite opinion as to its reliability. Difficulties have been encountered in the past with other types of prime movers—particularly in the early stages of their development—and I do not suppose that in this respect the double-acting engine will be an exception; but there is no reason why such difficulties should not be successively overcome.

There is insufficient time for me to attempt to discuss the problem of the propulsion of warships by oil engines, and I would recommend those who are interested to read the paper by Engineer-Captain R. Beeman before the Institution of Naval Architects in 1924, in which he dealt with some of the principal points bearing on the matter. The fact remains that the Admiralty has in the past been taken to task for not fitting oil engines into craft other than submarines, but I can assure you that the problem is not as simple as it would perhaps appear on paper, for although fuel economy is very desirable there are other points of importance that have rendered unsuitable the various oil-engine schemes that have been considered for warships from time to time. I am sure that if the complete history could be written it would be found that the Admiralty has been fully alive to the possibilities of the oil engine, as well as to its limitations. Even for craft other than warships, the oil engine, whilst playing an important part in marine propulsion, is not at the present time necessarily the best form of prime mover for all ships and for all conditions of service. The development of the oil engine must proceed step by step, and I sometimes wonder whether we are not going somewhat too fast. At any rate, with the developments that are taking place at the present time we, as engineers, must not regard the oil engine as the only prime mover worth consideration; nor must we regard those who are responsible for making the decision as to the type of propelling machinery to be installed in any ship as being enemies of progress because their choice does not rest with the oil engine. The marine engineers of the present day are generally fully alive to developments; and I feel that we have no reason to doubt that they will select that type of propelling machinery which, in their opinion, is best suited for the particular ship they may have under consideration.

* * *

The stresses to which the material of liners, covers and pistons are subjected are due to pressure and to the transmission of heat from the working fluid to the cooling water; the temperature stresses being generally the more important, and increasing in importance as the dimensions of cylinders are increased. In the design of any type of large oil engine, the possible temperatures reached by the working fluid throughout the cycle are therefore of the first importance; and I propose to refer to certain points which have some bearing on this matter.

The dimensions of any type of engine, for a given power and speed, are dependent upon the mean indicated pressure employed. So far as first cost is concerned, it is therefore desirable to employ as high a mean indicated pressure as practicable. In 1913 the highest mean pressure advocated was about 100 lb. per square inch for two-stroke and four-stroke engines. Since that date there has been a tendency to work at lower mean pressures, except in the case of four-stroke submarine engines where mean pressures have tended to increase with improvements in design. One must not, however, overlook the fact that a submarine engine is not generally called upon to develop its full rated power for long periods; it is a high-speed engine of special design and of moderate cylinder dimensions. The mercantile marine engine is in a different category; it has to run for long periods, so that the mean pressure at which it is intended to work continuously must necessarily be moderate.

On account of the differences in the mechanical efficiencies of the various types of engines it is not possible to compare their performances, as internal-combustion engines, by reference to their "brake mean effective pressure." It is not uncommon, however, to find the ratings of engines compared by the mean indicated pressures developed at their full rated powers. But this is also not a true comparison; it would only be true for engines of similar design and size working under similar conditions. The safe continuous rating of an engine is not dependent upon the mean indicated pressure, but largely upon the heat flow through the liners, covers, and pistons. It is quite possible for the rating of one engine to be moderate when developing a certain mean indicated pressure and for another engine to be overrated when developing the same or a lower mean indicated pressure; for example, a two-stroke crank case compression engine would probably be more highly rated when running with a mean indicated pressure of 40 lb. per square inch than a four-stroke engine of the same cylinder dimensions and speed when developing 80 lb. per square inch. I find this to be a point which is often overlooked.

The maximum continuous power that can safely be developed by an engine depends upon the heat flow through the liners, &c., and therefore upon the temperatures reached by the working fluid in the cylinder; and the latter depend, other things being equal, upon the quantity of fuel burned per stroke. The efficiency of combustion is consequently of the utmost importance in the oil engine, quite apart from the question of fuel economy, and the fuel valve may be regarded as the "heart" of the engine.

There has been a marked improvement in recent years in the fuel consumption of the Diesel engine, and in my opinion this has been largely due to modifications which have resulted in an improved distribution of fuel within the combustion space. In the early Diesel engines difficulties were encountered with the compressors fitted for supplying the blast air, and it was largely on this account that Messrs. Vickers developed the airless-injection system, which, as is now generally known, was fitted to the majority of pre-war British submarines. Since the war many firms in this country and abroad have followed Messrs. Vickers' lead, and the interest that has been aroused is evident from the number of articles on the airless-injection system that have appeared during the last few years in British and foreign technical publications.

For moderate mean pressures, which are ordinarily met with in marine practice, the airless-injection system has much to recommend it.

The efficiency of combustion in an oil engine depends upon the distribution and pulverisation of the fuel, as well as upon the temperature of the air in the combustion space and the cycle employed. The cooling effect of injection air lowers the temperature in the combustion space, and consequently a higher compression ratio is necessary with air injection than with airless injection. On the other hand, the distribution of the fuel is better in an air-injection engine, and it is largely on this account that the consumption per I.H.P. is superior to that of the airless-injection engine. If the distribution of fuel were as good in the airless-injection engine as in the air-injection engine then the former would be appreciably more efficient per B.H.P. than the latter owing to the saving in the power required to drive the blast compressor. The problem of the airless-injection engine is therefore almost entirely concerned with the distribution of fuel in the combustion space; and a large amount of experimental work bearing on this problem has been done during the last few years, resulting in considerable improvement.

In my opinion, the oil engine does not need "turbulence" in the gas-engine sense, but the air in the combustion space should be given an orderly movement, free from eddies, the direction of such movement depending upon the form of the combustion space and the position of the sprayer. This can be more readily obtained in the opposed piston than in the single-piston engine. In the Doxford airless-injection engine, for example, the scavenging air is introduced through tangential ports and the rotary motion thus given to the air persists during the injection period, and fuel consumptions of 0·37 lb. per B.H.P. have been recorded when using a good Diesel oil. Such consumptions have not been obtained, so far as I am aware, with any other type of slow-running marine two-stroke engine with the exception of the Still engine, which is a combined oil and steam engine.

Other designs have been produced with the object of increasing the movement of the air in the combustion space during the injection period and improved efficiencies have been reported. It appears to me, however, that it is difficult to avoid a certain amount of eddying in the case of single-piston engines, and the devices employed, although effective, are in the nature of a compromise. In the Hesselman design of four-stroke engine the inlet valve is partly masked so as to give a rotary motion to the air. Hintz also ran tests with masked and unmasked valves, and showed that the fuel consumption with the masked valve was not only dependent upon the position of the mask on the valve but also upon the velocity of the air within the combustion space. Too high an air velocity had an adverse effect upon the consumption, no doubt due to the interference of the sprays.

The movement of the air in the combustion space of a slow-speed airless-injection engine is undoubtedly of the greatest importance for efficiency, especially for mean pressures of the order of 100 lb. per square inch, but this movement must be suited to the period of injection and the number of sprays, and excessive eddy-making should, as far as possible, be avoided so as to reduce the possibility of the globules of fuel oil colliding with one another or striking the comparatively cool walls of the liner or cover. Smokeless combustion is of importance, for if the combustion of a portion of the fuel charge be incomplete then deposits will result, and such deposits may become a contributory cause to the sticking of piston rings in their grooves, rendering them inoperative as packing rings. The alternative to attempting to give an orderly movement to the air, in the case of single-acting single-piston engines, is to cause the fuel valve to move about its axis during the injection of the fuel, the angle of movement of the valve depending upon the number of holes in the sprayer. A design based on this principle was made some years ago at the Admiralty Engineering Laboratory, but owing to the complications involved, and to the pressure of more urgent work, the design was not developed.

The earlier Diesel engines operated on what is termed the constant-pressure cycle, *i.e.*, the fuel was injected by the blast air at such a rate that the maximum cycle pressure did not exceed the compression pressure. It was well known, before the development of the airless-injection engine, that an improvement in efficiency could be obtained by injecting the fuel earlier, thus departing from the constant pressure cycle and working with what used to be termed a "peak" on the diagram. This is the general practice to-day. The blast air in the Diesel, or air injection, engine has a cooling effect on the compressed air in the combustion space, and this cooling is absent in the airless-injection engine. When the airless-injection engine was developed, therefore, it was found that it would work satisfactorily with lower compression ratios than the air-injection engine, and the fuel was injected earlier, so causing a rise of pressure above the compression pressure, *i.e.*, the engine operated at what has since become known as the "dual" cycle. Experiments clearly indicate that, within limits, the thermal efficiency increases as the maximum cycle pressure is increased, but from the point of view of bearing loads, &c., it is desirable that the maximum pressure should be limited.

It is the expansion ratio and not the compression ratio that determines the thermal efficiency of an engine, and this is dependent upon the efficiency of combustion. With any method of fuel injection or self-ignition engines, it is necessary that the temperature of the air in the combustion space should be sufficiently high to ignite the injected oil in the time available, so that for a given engine, working under given conditions, there is a minimum compression ratio below which the engine will not function satisfactorily. In my opinion, it is preferable to work an engine with the minimum compression ratio; with the same fuel injection system, this minimum compression ratio will be determined by the temperature of the air at the commencement of compression, by the jacket-water temperature, by the speed of the engine, by the movement of the air in the cylinder, by the form of the combustion space and by the brand of fuel oil used. A marine engine must be capable of starting readily from the cold condition,

and it must also run satisfactorily at low powers, so that the starting and slow-running conditions may determine the minimum compression ratio that must be employed. Obviously, if the jackets are heated before starting an easy start on fuel can be obtained with a lower compression than would be necessary if there were no preliminary heating of the jackets.

In my opinion the best results, so far as fuel consumption is concerned, will generally be obtained by employing compact combustion spaces, because the compression ratio necessary to ensure satisfactory ignition of the fuel will be slightly lower, and with the lower compression ratio the fuel can be injected slightly earlier and the compression pressure will also be lower—a desirable feature in marine engines. I attach considerable importance, therefore, to the form of the combustion space. In engines where there is appreciable turbulence or eddying of the air, as distinct from an orderly movement of the air, the form of the combustion space is perhaps not so important, for such an engine would need a higher compression ratio in any case.

If temperature plays such an important part in the combustion of fuel in an engine, and if it is desirable to work with a low compression pressure, then why not heat the air by some means before compression commences ? This is a question that is frequently raised An increase in the temperature of the induction air, however, has the effect of reducing the volumetric efficiency ot an engine, *i.e.*, it reduces the weight of the working fluid within the cylinder, and the cycle temperatures will be increased unless there is an improvement in the fuel consumption or the quantity of fuel injected per cycle is reduced.

One of the advantages of the ordinary four-stroke engine is its high volumetric efficiency, due to the fact that the products of combustion are forced out of the cylinder by the movement of the piston during the exhaust stroke. The two-stroke engine is generally less favourable in this respect, for the scavenging process has to be completed in a much shorter time and scavenging is effected by the incoming charge of fresh air. The earlier two-stroke engines employed valve scavenging, which has the advantage that the admission of scavenging air is independent of the movement of the pistons, but a number of scavenging valves in the cylinder head leads to serious complication. The highest scavenging efficiency would be obtained if it were possible for the air to sweep the products of combustion from the cylinder without admixture, but this is an ideal that cannot be attained in practice.

The introduction of port scavenging simplified the two-stroke engine at the expense of the volumetric efficiency, and this was particularly noticeable in the case of engines of comparatively high speed. In recent years, however, the problem of scavenging has received considerable attention and the development of the slow-speed marine engine has enabled higher volumetric efficiencies to be obtained.

From my observations I have concluded that if a two-stroke engine, having a somewhat low volumetric efficiency when developing its rated power, starts readily from cold, without preliminary warming of jackets, the temperature at the end of compression, when the engine has been running for some time and is thoroughly warmed through, is generally more than sufficient to ignite the injected oil satisfactorily at the rated full power. With such an engine it is, in my opinion, inadvisable to work with hot jackets when running at full power, as the heating of the jackets tends further to reduce the volumetric efficiency. In this instance better results would probably be obtained by reducing the compression ratio slightly and warming the jackets to ensure an easy start from the "cold" condition; then, when the engine is thoroughly warmed through, by gradually reducing the temperature of the jacket water and injecting the fuel slightly earlier so as to work up to the same maximum cycle pressure as before. On the other hand, should the compression ratio of an engine having a low volumetric efficiency be insufficient for the satisfactory combustion of the fuel when the engine is thoroughly warmed through, I should prefer to increase the compression ratio slightly and not to overcome the difficulty by heating the induction air, as the latter would further reduce the volumetric efficiency and increase the cycle temperatures. This reasoning does not necessarily apply to an engine having a high volumetric efficiency, as if a low compression ratio is employed, and it is necessary to warm the jackets before starting, it may be necessary to work with hot jackets when the engine is developing its full power to ensure that the combustion of the fuel is sufficiently rapid to give the desired results. There may, therefore, be some advantages attached to the use of hot jackets in some instances, but, apart from the considerations to which I have referred, with cool jackets there is one thing less requiring the special attention of the watchkeeper, and cylinder lubrication may be more satisfactory, especially with large slow-running engines.

I have already mentioned that the temperatures reached by the working fluid in an engine determine the heat flow through the cylinders, &c., and therefore to a great extent limit the permissible continuous power of a given design; and volumetric efficiency and cycle temperatures are, therefore, of the utmost importance—particularly for large engines. Cycle temperatures may be reduced by reducing the quantity of fuel burned in the cylinder, *i.e.*, by working with a reduced mean pressure, or by supercharging.

Supercharging is not a new idea; it was originally proposed by Daimler. Supercharging experiments were carried out by Junkers with his opposed-piston oil engine, and he referred to the advantages of supercharging in a paper which he read in November, 1911. But, with the exception of some experimental installations, very little has been done with supercharging until recently, and there are now a number of marine four-stroke engines fitted with superchargers.

Some interesting results have been obtained with an experimental installation fitted with the Büchi system of supercharging. The engine tested was a four-cylinder four-stroke engine, normally developing 500 B.H.P., and the air was supplied by a two-stage blower driven by an exhaust gas turbine. These results showed that even though the power was increased by 50 per cent. with supercharging the heat stresses were about the same as when the engine was running without supercharging.

It would appear, from recent patents, that the supercharging of two-stroke engines is receiving some attention, but the problem is in some respects somewhat more difficult with this type of engine than with the four-stroke engine, particularly for high engine speeds. If there is only one source of air supply for scavenging and supercharging, then to maintain the efficiency of scavenging in the supercharged engine it is necessary to create a back pressure in the exhaust ports during the scavenging period; this can be done by means of a throttle-valve in the exhaust pipe, which was the method adopted by Junkers in his experimental opposed-piston engine. A method which I proposed some years ago, and which was embodied in an experimental two-stroke engine, was to introduce the scavenging air through ports in the usual manner and to supercharge the cylinder with air at a higher pressure through a row of ports, controlled by a mechanically-operated valve, placed above the scavenging ports. This necessitates the provision of air at two pressures, namely, at the scavenging pressure and at the supercharging pressure, but although it introduces complications it has some advantages.

With the object of limiting cycle temperatures in the large marine engine, and therefore the temperature stresses in the material of parts in contact with the working fluid, without having recourse to a reduction in the mean indicated pressure, in my opinion, it is necessary to pay particular attention to the shape of the combustion space, the movement of the air within that space, to the volumetric efficiency and to the efficiency of combustion.

THE total traffic through the Welland Ship Canal for the 1927 season ending in November was 7,193,576 tons, an increase of 2,041,911 over the same period in 1926.

Physical and Optical Societies' Exhibition.

No. I.

THE eighteenth annual Exhibition of the Physical and Optical Societies, which was held at the Imperial College of Science and Technology from Tuesday to Thursday of this week, was, as usual, extremely interesting. While many Exhibitions lack originality and fail to satisfy those looking for new ideas, the annual display of scientific apparatus and instruments at South Kensington invariably presents many new and interesting features. From an electrical point of view, the Show has become one of considerable importance, for owing to the amount of research work that is now carried out and to the scope which the electrical industry offers to inventors, every year important advances are made by manufacturers of electrical apparatus. The electrical instrument industry has made wonderful progress, and few who visit the Physical and Optical Societies' Exhibition and inspect the many ingenious instruments to be seen there, probably realise that at one time the brilliancy of an electric lamp served as an indication of dynamo voltage. To-day, however, a central station engineer can obtain accurate readings of temperatures, pressures and so forth in his office, and even a continuous indication of the wave form.

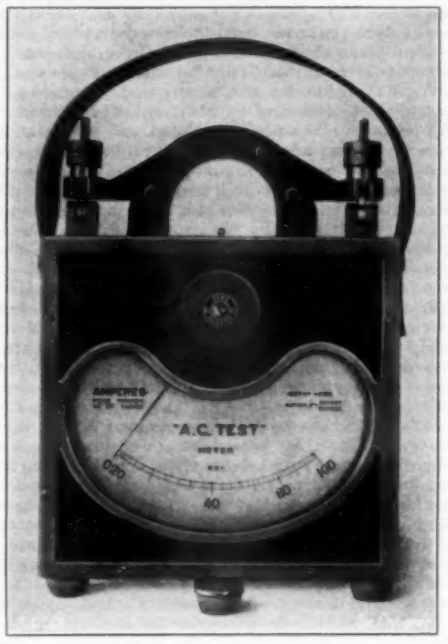


FIG. 1—PORTABLE AMMETER

For several years past wireless apparatus has constituted a special feature of the Show, and has attracted many visitors, who hitherto took little or no interest in scientific affairs. On this occasion the wireless exhibits were more numerous than ever. Besides wireless sets designed in accordance with the most advanced ideas, there were all sorts of modern accessories, such as battery-charging rectifiers, power units for giving H.T. and L.T. supplies, shielded valves, condensers, &c. The Marconi shielded valve, developed by Captain Round, created a good deal of interest. Self-oscillation has long been the drawback to high-frequency amplification, but the introduction of this new valve will, it is believed, have an important influence on the problem of overcoming the difficulty, and receiver design will undergo modification during the present year. The electric "pick up" system applied to gramophones also attracted much attention. Gramophone reproduction

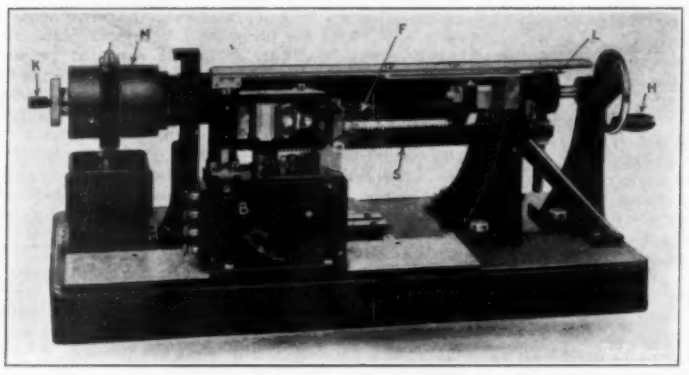


FIG. 2—LOW-PERIODICITY VIBROGRAPH

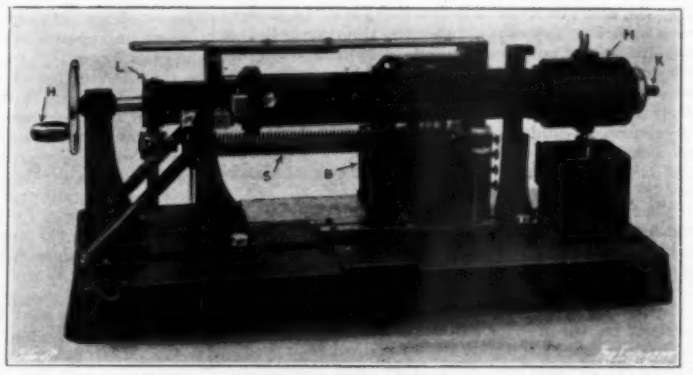


FIG. 3—BACK VIEW OF VIBROGRAPH

obtained in this manner is exceptionally good, and some maintain that the time is not far distant when the gramophone in its ordinary form will to a large extent give place to a combination instrument, which not only receives and reproduces the broadcast programmes, but which also affords a means of reproducing electrically, *viâ* the loud speaker, the latest gramophone records.

A portable multi-range ammeter operating on an original principle was exhibited by Crompton, Parkinson, Ltd. The instrument, which is shown in Fig. 1, is mounted in a varnished oak case, and it is operated magnetically by the field of a conductor passed through a pack of iron stampings. As the illustration, Fig. 1, shows, the magnetic core formed by the iron stampings projects above the case, and the projecting part is removable so that the cable may be put in position. No electrical connections are necessary, for the field set up by the cable is used directly to operate the instrument. The magnetic flux across the gap in the ring of stampings operates on specially shaped pieces of iron, which are free to move. By altering the shape and position of these moving parts, wide variations in the scale markings may be obtained. The scales may be cramped at either end or may have almost evenly spaced markings over a large part of the dial. As the scale reading depends upon the ampère turns in the primary, every instrument has as many ranges as the number of turns passed through the middle of the iron core. An ammeter with a scale of 0–600 ampères, and having one turn on the iron core, would give a full-scale deflection with 600 ampères flowing in the cable; whilst with two turns the full scale deflection would be given with 300 ampères. Hence, the reading indicated on the instrument divided by the cable turns, gives the value of the current being measured. If a coil with a suitable number of turns be mounted on the core, the instrument may be used to measure potential as well as current. While the instrument is primarily intended for use on A.C. circuits of 25 to 100 cycles per second—when its accuracy meets the requirements of the 1926 B.E.S.A. specification No. 89 for first-grade instruments—reasonably correct readings can also be obtained on direct-current circuits.

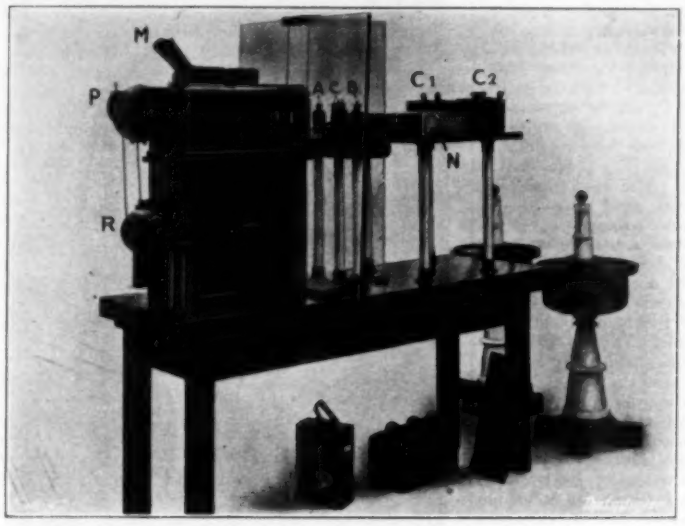


FIG. 4—H.T. DUDDELL OSCILLOGRAPH

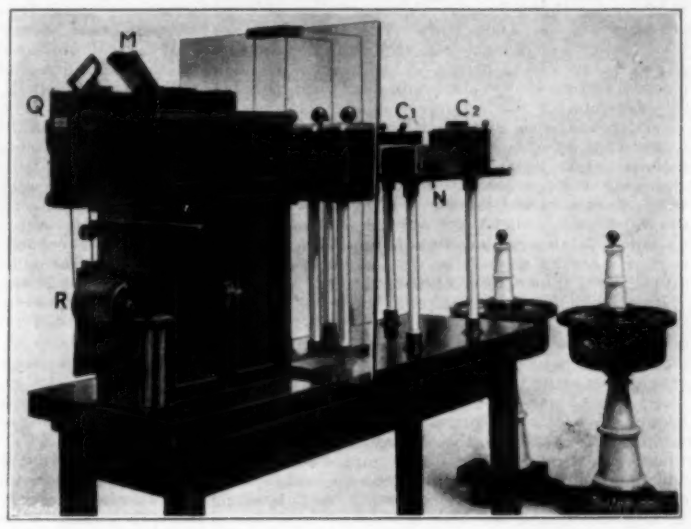


FIG. 5—OSCILLOGRAPH WITH FILM CAMERA

FIG. 6—CONDENSER FOR OSCILLOGRAPH

The Cambridge Instrument Company invariably exhibits something new, and this week it surpassed all records. Quite a number of original and interesting instruments were on view on the company's stands, some of which we shall consider in a subsequent article. The low-periodicity vibrograph, shown in Figs. 2 and 3, is a robust and compact instrument, by means of which permanent records can be obtained of vertical vibrations of low periodicity, such as those which are met with on board ship. The main feature is the method of recording, which does not depend upon optical or photographic methods but which is capable of great accuracy when recording vibrations of small or large amplitude and high or low frequency. The records are obtained by the action of a moving stylus upon a transparent celluloid film. Owing to the low elastic limit of this material, plastic deformation of the celluloid surface occurs under comparatively low pressures, and by using a stylus having a minute spherical point, smooth, plastic flow of the material is obtained with an extremely small expenditure of energy. The line produced possesses optical characteristics entirely different from those of a scratch. When viewed microscopically by transmitted parallel light, the indentations appear as a narrow, sharply defined, dark band on a bright background, with a still finer bright line in the centre of the dark band. Measurements of the magnified records can thus be made with a high degree of accuracy, and these characteristics

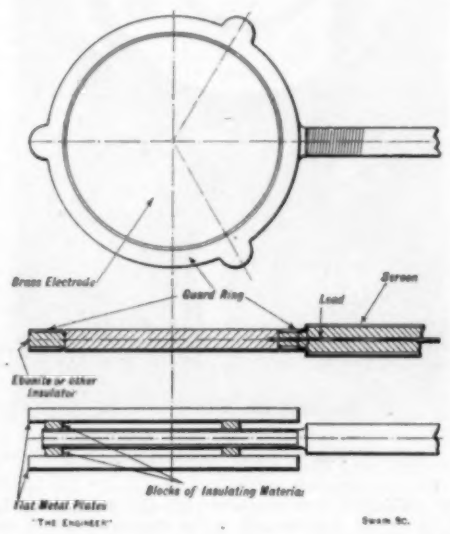


FIG. 7—METHOD OF FORMING TEST CONDENSER

The instrument comprises a weight M attached to a horizontal lever L, pivoted to a stand which, when placed upon a structure, partakes of its vibrations. Since by reason of its inertia the weight tends to remain at rest in space, the vibrations of the instrument cause the lever to execute small rocking movements, which are recorded on the celluloid strip by the fine stylus carried at the end of a flat spring attached to the lever. The celluloid strip F, which is 35 mm. wide, is moved past the stylus by means of an electric motor clock, the speed of which can be varied within wide limits. An independent zero line is also traced on the inner surface of the strip by a second stylus, controlled by an electro-magnetic time-recording device. The periodicity of the moving system can easily be varied from about one to four seconds by slackening the tension of the spring S, by rotating handle H, and raising or lowering the spring relative to the lever L. The recording stylus can be moved into a number of different positions relative to the lever, corresponding positions being provided for the box B, which carries the moving film with its associated mechanism, so that the amplitude of the records obtained compared with the actual movements recorded, may either be unmagnified, or may be reduced from 1 : 1 to 8 : 1 in five steps. By means of adjustable fluid damping, the effect of disturbing frequencies of high periodicity may be practically eliminated. The lever L and the weight M may be clamped in position by rotating the knurled head K,

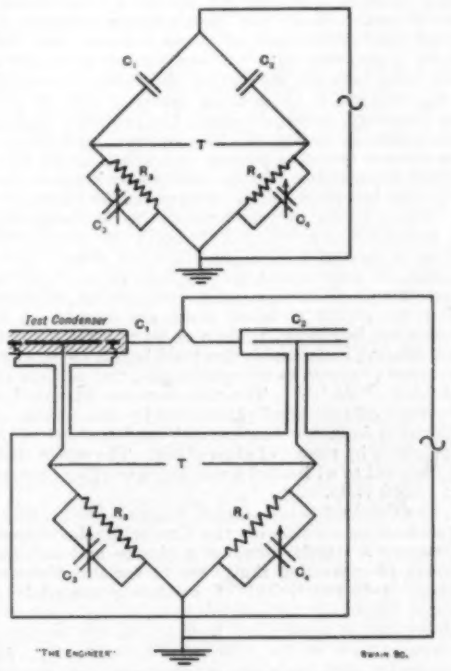


FIG. 8—SCHERING BRIDGE CONNECTIONS

thus preventing any possibility of damage when the instrument is being carried about. The time marker generally employed with the instrument is arranged to make and break an electric circuit at regular intervals of one second, causing definite movements of the time-recording stylus at these intervals. The celluloid strip is supplied in rolls of sufficient length for the production of a large number of records, while a new strip can be readily and easily inserted in the instrument. The apparatus is run from a 6-volt battery.

Another of the Cambridge Instrument Company's exhibits is a Duddell oscillograph outfit, suitable for pressures up to 75,000 volts. The apparatus—see Figs. 4 and 5—includes two electro-magnetic vibrators A and B, similar in design to the original Duddell pattern, and one electro-static vibrator C. It is possible to substitute for this arrangement any combination of electro-magnetic and electro-static vibrators, the former type being more suitable for obtaining current records, while the latter is suitable for use when obtaining voltage records at very high pressures. Only one camera and one source of light are required, the source of light being a 6-volt metal filament lamp to which an abnormal voltage is applied for a fraction of a second during the time of exposure. The intense light thus obtained passes through an optical system, which ensures that a separate beam is focussed on each vibrating mirror. The reflected beams pass through a cylindrical lens, thereby reducing the images to bright spots of light on the photographic paper or film, which is moved in a vertical plane at right angles to the plane of the vibrating beams. Visual observations are made possible by use of rotating mirrors, the observations being made, when desired, at M. The electro-magnetic vibrator, which is somewhat smaller than the original Duddell device, is provided with adjusting and levelling arrangements, and the lens is recessed into the oil bath, so as to be as near as possible to the mirror. The maximum R.M.S. current is 0·1 ampère. The electro-static type is connected in series with the condenser shown in Fig. 6, which reduces the pressure to a suitable value at the oscillograph terminals. The two vibrator strips, insulated from one another, are charged oppositely by the battery N, the electrical centre of which is connected to a point between the two condensers C_1 and C_2. These are joined in series and connected between the terminals of the oscillograph, thus making the potential of the strips definite in relation to the field plates. C_2 is an adjustable condenser which enables exact electrical balance to be obtained when the instrument is undamped; that is to say, when there is no oil in the damping chamber. The natural periodic time of both types of vibrator is about 0·0003 second. When the electro-magnetic vibrator is damped, the deflection produced at a scale distance of 60 cm. is 2 cm. for a direct current of 60 ma. With the electro-static vibrator an amplitude of vibration of about 6·2 mm. per 1000 volts is obtained with a direct-current potential of 400 volts between the strips. Normally, a rotating drum camera P is used, as shown in Fig. 4, but, alternatively, a cinematograph film camera Q may be employed, as in Fig. 5. The latter is used when a continuous record is desired, any length up to 30 m. being obtainable. The metal filament lamp is then replaced by an arc lamp. The camera is loaded in a darkened room, the photographic paper being held in position by a novel form of clamp. Rotation of the drum is produced by a variable-speed direct-current motor, the paper speed varying from 40 cm. to 60 cm. per second. A mechanical device is fitted to ensure that the record is taken when the lamp is at its maximum brilliancy, while a series of cams fitted to the drum spindle enable the total length of paper on the drum camera to be used in one, two or four exposures as desired. The vibrators are mounted in separate oil baths and placed side by side. They are insulated from one another and from the rest of the apparatus by means of glass plates. The whole outfit is designed to withstand a maximum working pressure of 75,000 volts.

The Cambridge low-tension Schering bridge, which was another exhibit on the Cambridge Instrument Company's stand, provides a simple and accurate means of measuring the power factor and dielectric constant (permittivity) of insulating materials at audio frequency. Provision is made for measuring power factors from 0·001 to 0·5 with test capacities varying from 60 to 1000 micro-microfarads. The electrodes and leads are screened so that samples may be tested at a controlled temperature and humidity. The bridge is direct reading, and easy to operate. Samples may, in fact, be tested at the rate of about forty to fifty per hour. The material to be tested is made up in the form of a condenser by placing pieces of the sample on either side of a guarded central electrode, and enclosing the whole between two circular flat plates of metal. The guard ring and the screen of the lead from the central electrode are connected to earth. The diagram, Fig. 7, shows details of the arrangement. The testing apparatus is set up in the form of a Schering bridge,* as shown in the upper diagram, Fig. 8, while the lower diagram, Fig. 8, shows the arrangement of the screens.

C_1 is the test condenser; C_2 is a calibrated low loss variable condenser; C_3 is a small uncalibrated variable condenser with a maximum capacity of approximately 250 micro-microfarads; and C_4 a variable condenser with a maximum capacity of approximately 1100 micro-microfarads, calibrated directly in power factors at 800 cycles per second; R_3 and R_4 are equal low-inductance high resistances; and T is a high-resistance telephone.

It can be shown that, to a close degree of approximation, the power factor of $C_1 = \tan\theta = R_4C_4 - \omega R_2C_2 = \omega R (C_4 - C_2)$, where $\omega = 2\pi$ times the frequency of the source of supply and $R_4 = R_3 = R$. If the frequency of the source is kept constant, ω is constant; and if R is chosen so that ωR is equal to some constant K, $\tan\theta = K (C_4 - C_2)$.

If the scale of the condenser C_4 is calibrated in micro-microfarads, it is possible to correct for stray capacities across R_3 and R_4 by a preliminary balance with a no-loss condenser in the place of C_1, and by adjustment of C_2 keeping C_4 on the zero of its scale. On replacing the no-loss condenser by the test condenser and balancing by adjustment of C_2 and C_4, power factor $= \tan\theta = K$ (reading on C_4). The test condenser is so designed that the effect of stray capacities is eliminated and the preliminary balance serves to determine the capacity of the test condenser with air di-electric. The guard ring is provided with three equally spaced projections and six small blocks of the sample representative of the thickness of the material are used to support the central electrode between the plates, as shown in Fig. 7. This arrangement forms a condenser free of loss, since any leakage across the blocks is only a shunt on the source. If C_2' be the reading on C_2 for the preliminary balance—*i.e.*, the capacity of the test condenser with air dielectric—and if C_2'' be the reading of C_2 in the test balance, the permittivity of the sample $= C_2''/C_2'$.

The apparatus comprises a low-tension bridge unit, a test condenser with screened leads, an 800-cycle fixed-frequency valve generator, and a sensitive telephone with screen and flexible leads.

One of the exhibits of the Foster Instrument Company is the heat-loss gauge shown in Figs. 9 and 10. The instrument may be used for measuring the heat-loss from the surface of boiler settings and other hot bodies. The surface of a capsule is exposed to the heat emanating from the surface under test, either

FIG. 9—HEAT-LOSS GAUGE

by making direct contact with the surface or by holding the instrument at a distance, when the radiant heat is measured. The capsule is connected to a sensitive pressure gauge, and there is a small leak through a capillary tube. The air inside the capsule becomes heated, and the rise in pressure is indicated on the gauge. This rise in pressure continues until the leak through the capillary just balances the rate at which the heat is received by the capsule, and at this stage a steady reading is maintained on the scale for several seconds. The heat-receiving surface of the capsule is surrounded by a guard ring, behind which there is a water jacket which maintains the remainder of the instrument at a practically constant temperature. The water jacket is provided with a thermometer, although the jacket temperature can vary several degrees Centigrade before any appreciable change in the calibration occurs. The cooling water need only be changed when a long series of tests is being made. The capillary leak is in a cell which can be charged to give a different range for the heat equivalent for the gauge readings. The capillary is covered by a filter, so that when the air is sucked in when the gauge is removed from the hot surface, there is no danger of drawing in dust which might block the capillary. To facilitate cooling the instrument, and thus shortening the time for the gauge to be ready for a second reading, air is circulated round the outside of the capsule by means of a rubber bulb, to be seen in Fig. 9. A calibration table, supplied with the instrument, gives the meaning of the gauge readings in terms of grand calories per square metre or in British thermal units per square foot in unit time. A spare filter and cell are provided,

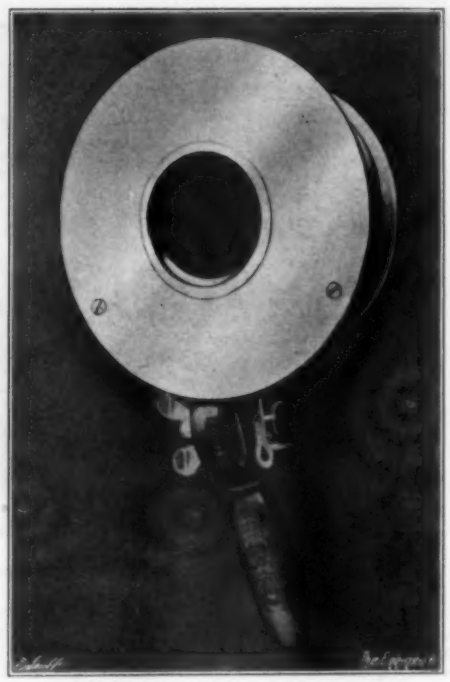


FIG. 10—BACK VIEW OF HEAT-LOSS GAUGE

so that when the instrument is used in very dirty situations, a series of readings need not be interrupted in order to renew the filtering medium. The instrument was invented by Captain A. Blackie.

(To be continued.)

* H. Schering. "Modified Wien Bridge." *Zeit. für Instrumentenk.* 1920, XL., 124.

SIXTY YEARS AGO.

IN spite of the much smaller scale on which coal mining was practised in this country sixty years ago, as compared with to-day, the annual loss of life and limb was scarcely less. Each year the number of fatalities in coal mines amounted to about a thousand. Towards the end of 1867 two disastrous explosions, one at the Oaks Colliery and the other at the Ferndale Colliery, had at last aroused public opinion to the severity of the miner's lot and the risks he ran in the pursuit of his occupation. We entered the lists on his side and took a stout stand against the perpetuation of the antiquated arrangements for the safe working of mines then in common use. The first object of our criticism was the miner's "safety" lamp. We described it as a snare and delusion, partly because it was so constructed that it could be disastrously misused by an ignorant miner, but principally because it was relied upon to protect the miner to the neglect of proper ventilation. We deplored the day when the safety lamp replaced the naked candle in mines. Had the use of candles been continued, we said, it would of necessity have compelled the adoption of improved means of ventilation. As it was, the production of ventilating currents continued to be effected by means of furnaces at the upcast shafts. We argued very earnestly in favour of the complete abolition of the furnace system and its replacement by mechanically driven fans. Whatever we may think nowadays of our attack on the miner's safety lamp, we cannot feel otherwise than pleased that we led the way in advocating the adoption of fans in place of furnaces. Our advocacy brought hot criticism about our ears. In our issue of January 10th, 1868, we published a letter containing "an ungracious attack ungraciously worded," in which the writer, a mining engineer, accused us of filling our columns with the discussion of a subject about which we knew nothing. Our correspondent, after merely denying the truth of our argument about safety lamps, described the furnace as "our tried and trusted friend" and as "the simplest, cheapest, most easily managed, the safest, most reliable, and best understood appliance yet brought in use." We did not allow his criticism to pass unchallenged. Having instructed him in the rules of courteous debate, we recapitulated our arguments and concluded by asserting that the precautions taken to preserve life in British mines were criminally short of what they ought to be. A large part of the unfortunate position was ascribable to the negligence, parsimony or ignorance of colliery proprietors and their officials and, in particular, of the engineers whom they employed.

A FACTORY for the production of synthetic methyl and ethyl alcohols is, says the *Chemical Trade Journal*, to be built near Venice by the Societa Anonima Distillazione Italiana Combustibile (D.I.C.S.A.). The Salerni process will be used. The Societa Mineraria di Valdarno is to build a synthetic petrol plant with a daily output of 50 tons.

Railway Matters.

THE Buenos Aires Municipal Council has decided to reject the offer put forward by a London group, headed by Lord Ampthill, to construct an underground railway.

THE first underground railway in the Far East was opened in Tokio on the 30th ultimo. It has been constructed on the pattern of the New York subway, and is to be earthquake-proof.

THE extension of railway accommodation from the Kenya-Uganda frontier at Tororo to Jinja on Lake Victoria was opened on January 11th, and thus Uganda was given railway communication throughout to the coast.

As a consequence of the thaw last week there was a slip on the Southern Railway between Coulsdon and Merstham and both lines have been closed. The Coulsdon and Earlswood deviation line has, however, kept through communication open.

WITH a view to giving the night gang an extra two hours' complete possession of Clayton Tunnel—where, as related in this column on December 2nd, a large culvert is being renewed—some of the late evening trains between London and Brighton travel *vid* Horsted Keynes and Lewes.

THE front of the Metropolitan District Station at Mansion House is to be modernised. It will be rebuilt in Portland stone. The stations at Blackfriars, Temple, Westminster and Victoria have already been dealt with, and Charing Cross, St. James' Park and West Kensington are in hand.

LAST week's traffic returns completed the record for the year 1927, and showed that, compared with 1925, each company had a reduced passenger traffic to the following extent :—London, Midland and Scottish, £2,292,000 ; London and North-Eastern, £1,670,000 ; Great Western, £755,000 ; Southern, £528,000. Each, though, had an increase in the goods traffic, the figures being :—London and North-Eastern, £2,845,000 ; London, Midland and Scottish, £1,906,000 ; Great Western, £1,174,000 ; and Southern, £106,000.

IN this column of our issue of November 18th mention was made of permission having been given to the Belfast and County Down Railway by the Irish Wages Board to reduce its salaries and wages by 10 per cent. The other railway companies in Ireland thereupon wished for a similar concession, and towards that end proposed to reduce the commencing wages of all new entrants. The Wages Board has now decided that the reduction proposed would be too drastic, and that on Group I. roads the commencing rate may be 10 per cent. lower and on Group III. roads the reduction to be one of 5 per cent.

THE subjects to be discussed at the International Railway Congress in Madrid in 1930 have now been announced. They are :—(1) The use of concrete and reinforced concrete on railways ; (2) resistance of rails against breakage and to wear ; (3) investigation into static and dynamic stresses in railway bridges ; (4) recent improvements in permanent way tests and in the scientific organisation of maintenance work ; (5) locomotives of new types, in particular, turbine locomotives and internal-combustion motor locomotives ; (6) improvements in the steam locomotive ; (7) electric locomotives for main line traction ; (8) all steel coaches—comparison with vehicles built of wood ; (9) relations between railways and seaports ; (10) methods to be used in marshalling yards to control the speed of vehicles being shunted ; (11) signalling ; (12) economical traction methods for use in particular cases ; (13) competition of road transport ; (14) use in railway work of machines for accountancy ; (15) co-operation of the staff ; (16) training of the staff ; (17) and (18) light railways ; (19) electrification of secondary lines ; (20) rail motor vehicles.

THE adoption by the London, Midland and Scottish and the London and North-Eastern companies of containers for conveying consignments in bulk is another illustration of the fact that there is nothing new under the sun. Travellers to the Continent have seen, for many years, such means used for registered luggage between London and Paris. We would, however, more particularly refer to their early use by such carriers as Pickfords and Suttons. It is generally known that railway companies were not, at first, carriers ; they provided only the track. When, later, they also became carriers they were jealous of the older established firms and, in time, objected to carrying the latter's consignments in bulk as one item ; they wished to charge carriage on each individual parcel. Under Great Western Railway Company *v.* Sutton the case was fought and won by the carriers in 1869. It is interesting to recall that the use of containers was part of the scheme of the late A. W. Gattie, and it is instructive now to read in "A London Transport Trust"—P. S. King and Son, Ltd.—what objections the late Mr. E. H. Pratt, a well-known railway publicist, had to them. Actually they were one of some of the good points in that scheme.

ACCORDING to the Board of Trade returns, the value of the railway materials exported during the first eleven months of last year was as follows, the corresponding figures for 1926 and 1925 being added in brackets :—Locomotives, £2,053,870 (£294,060, £2,348,430); rails, £3,143,363 (£1,331,633, £1,711,502) ; carriages, £2,913,241 (£2,538,142, £1,444,433) ; wagons, £2,837,202 (£2,638,990, £3,283,487) ; wheels and axles, £772,276 (£405,937, £548,249) ; tires and axles, £663,221 (£272,492, £413,207) ; chairs and metal sleepers, £1,332,865 (£636,558, £942,103) ; miscellaneous permanent way, £1,378,499 (£1,026,973, £1,319,878) ; total permanent way, £7,531,456 (£3,838,492, £5,121,178). The weight of the rails exported was 300,000 tons (163,665 tons, 185,219 tons), and of the chairs and metal sleepers, 134,786 tons (65,451 tons, 85,795 tons). During the month of November last locomotives to the value of £327,518 were sent overseas, which included :—India, £208,216 ; Ceylon, £58,030 ; the Argentine, £31,518 ; other countries than the Argentine in South America, £12,217 ; Australia, £7213. During that month there were also shipped rails to the value of £375,587, which included :—India, £167,445 ; the Argentine, £82,861 ; Portuguese East Africa, £20,802 ; South Africa, £9152 ; Chili, £7258 ; New Zealand, £7215 ; and British West Africa, £4179.

Notes and Memoranda.

AN article in the *Chemical Trade Journal* attracts attention to the growing vogue for rubber-containing paints in America, which are said to possess exceptional lustre, flexibility and permanence.

THE net result of the investigations made by the Industrial Research Board into the atmospheric conditions of cotton mills is that the data have not disclosed any significant difference between the sickness rates of weavers in humid and non-humid sheds.

ACCORDING to the Dominion Bureau of Statistics at Ottawa, automobile parts and accessories manufactured in Canada during 1926 reached a total value of 13,914,965 dollars, an increase of 24 per cent. over the 11,234,828 dollars reported for the previous year.

IT is reported from Stockholm that a method has been introduced of utilising the waste products of the sulphite pulp factories and the saw mills for the production of an industrial and domestic fuel. The sulphite lye is evaporated, mixed with sawdust and the waste of the saw mills, and then dried. The resulting product, containing about 60 per cent. of the dried sulphite lye and about 40 per cent. of dried wood, is pressed into briquettes for use as domestic fuel or ground into powder for industrial steam-raising purposes.

IN an article in *Engineers and Engineering* on the distribution of insecticides by aeroplanes, Mr. I. E. Auerbach says that when the dusting was done by hand all the work was done at night by the flare of gasoline torches, as it was necessary to utilise the dew in making the poison stick, but, with the use of the aeroplane night work is eliminated, for the propeller blast induces in the poison a positive charge of static electricity which causes it to adhere to the negatively charged cotton plant in dry weather as well as moist.

A NEW arc welding machine with two heads has been produced in America with which very high speeds are attained. For welding ¼in. plate, the seam is prepared by bevelling to an angle of 30 deg. total opening. With ⅛in. electrode and approximately 250 to 300 ampères in each arc, a speed of welding of from 5in. to 7in. per minute may be obtained. Thus the speed of welding is approximately ten times that obtained with a single arc manually controlled, and the resulting weld is of better quality because of the decreased chance of burning the weld.

A SPECIALLY sensitive qualitative test for zinc is described by W. H. Cone and L. C. Cady, of the University of Idaho, as follows : To the solution to be tested are added 5 drops of diphenylamine-acetate solution (1 gramme diphenylamine dissolved in 100 cc. glacial acetic acid) and 5 cc. of potassium-ferricyanide solution (0·5 per cent. aqueous solution). If zinc be present, a dark brown, green or purplish-black turbidity appears immediately. This test is more delicate than the cobalt zincate test for zinc, and may be used for the colourimetric estimation of the amount of zinc present.

ACCORDING to the *Industrial Australian* there was started in 1911, at an estimated cost of £224,000, the construction of a new locomotive depôt at Mayne Junction, Brisbane. Up to date, £449,519 has been expended, and it will take another £191,000 to complete the depôt, making a total of £640,519. The Queensland Minister for Railways, in explanation of the greatly increased cost of construction, said that since the estimate was framed wages had increased 131 per cent.; material, steel rails, 93 per cent.; and timber, 102 per cent. He also claimed that the original scheme of lay-out had been so enlarged and altered that no real comparison could be made.

IN a paper read before the British Association of Refrigeration, Dr. E. Griffiths gave some particulars of the plant required on ships conveying refrigerated apples, and said that from the data obtained in an investigation, the heat evolution at a temperature of 20 deg. Cent. from 100,000 bushel cases of apples would be at a rate equivalent to 132 H.P., so that the heat produced by the process of respiration of the fruit would account for not less than one-tenth the duty of the machine. Comparing the heat evolution of the apples with that conducted in through the insulated sides of the ship, it may be stated that the ratio of the heat evolution by the apples to the heat conducted in through the sides is as 1 is to 3.

ACCORDING to the *Pharmaceutical Journal*, the fact that Siemens and Halske have succeeded in working tantalum into larger blocks and sheets for the manufacture of basins, &c., indicates that the metal is likely to replace to some extent platinum in the chemical laboratory. Its price is about one-twelfth that of platinum. The melting point of tantalum stands 1000 deg. Cent. higher than that of platinum, at about 3100 deg. Cent. Heated up to dull redness, it is only affected by hydrofluoric acid. Tantalum dishes can be used for dissolving platinum and gold in *aqua regia*. Palorium, another platinum substitute, is an alloy of gold and metals of the platinum group, of the appearance of platinum melting at 3100 deg. Cent.—distributed by the Palo Company, New York. It is said to be of higher resistance against melting alkalis and concentrated H_2SO_4 than platinum. Its price is almost 45 per cent. below that of platinum.

ACCORDING to Captain H. C. Richardson, U.S.N., the welding of steel, in aeroplane construction, particularly chrome molybdenum steel, is very generally accepted as satisfactory practice in America, with the limitation, however, that welds in tension are not considered reliable. To avoid this, it is usual practice to introduce gussets at joints or long scarfs in which adequate welding is presented in shear ; and where the loads are high it is usual to slot the gussets through the members to gain additional shearing values. In such cases it is also usual to incorporate in these gussets the attachment lugs for connecting other members. Electric and gas welding are acceptable, but acetylene welding is considered hazardous. In all welding, since it is impracticable to determine the interior condition of a weld by inspection, it is considered essential to have this work done by skilled and reliable workmen. Local reinforcements are often accomplished by brazing. If brazing is to be associated with welding, it should be done subsequent to the welding.

Miscellanea.

THE ports of Welshpool and Lake Entrance, Victoria, are to be developed at a cost of about £100,000.

THE Mining Department of the North Staffordshire Technical College is to be extended at a cost of £12,000.

AN effort is to be made to raise one of the Emperor Caligula's barges, which has lain at the bottom of Lake Nemi, near Rome, for some 1900 years.

THE timber seam, which has been found at the Hook Colliery in the western part of Pembrokeshire, is 9ft. thick and provides some very good anthracite.

LAST year's revenue from the transit of ships through the Suez Canal amounted to 207,310,000f., as compared with 186,590,000f. in 1926, and 192,070,000f. in 1925, the previous record year.

THE Western Canada Grain Pool contemplates spending 5,000,000 dollars during the coming year in extensions of facilities in country elevators and termini in Western Canada. The building programme includes 100 or 150 country elevators in Alberta, where 160 are already in operation ; 150 in Saskatchewan, where there are now 730, and 40 in addition to the 50 elevators in Manitoba.

AT the meeting of the London Section of the Society of Chemical Industry on Monday, January 2nd, Dr. G. W. Monier-Williams, who recently retired from the honorary secretaryship, after holding that position for seven years, was presented with a clock and album containing the names of those who subscribed to the presentation, as a mark of appreciation of his valuable services during his term of office. Over 250 members subscribed.

IT is proposed to develop the antimony deposits at Lake George, New Brunswick. The power plant has already been ordered, and it is planned to install a concentrating mill at the mines, to be followed by a smelter, so that the finished metal as well as by-products will be manufactured in New Brunswick. World shortage of antimony and soaring prices, it is said, make this an auspicious time for proceeding with the extensive development at Lake George.

A NEWLY discovered river in Alaska is the Chakachatna, the drainage basin of which covers an area of more than 1100 square miles. This stream is a roaring torrent too swift and too deep to be forded even with horses ; in fact, measurement of its current at several places showed that it was flowing at an average speed of 15 miles an hour. This river rises in Lake Chakachamna, 23 miles long, which is hemmed in between lofty mountains, and is backed by a great glacier that lies athwart the general trend of the valley.

THE Canadian Government proposes to ask Parliament for authority to build two destroyers at a cost of 1,000,000 dollars each to replace the obsolete destroyers Patriot and Patricia—says the Ottawa correspondent of *The Times*. The Government has obtained from the British Government the loan of the destroyers Torbay and Toreador until the new destroyers are ready. These borrowed ships will be reconditioned immediately at Portsmouth and are expected in Canadian waters before April. The new vessels will probably be built in this country.

IT is announced that Mr. R. S. Hilton, managing director and deputy chairman of the Metropolitan-Vickers Electrical Company, Ltd., Manchester, has accepted the position of sole managing director of the United Steel Companies, Ltd. The United Steel Companies, Ltd., is one of the largest industrial combines in this country, among its constituents being Steel, Peach and Tozer, Samuel Fox and Co., Frodingham Iron and Steel Company, Workington Iron and Steel Company, Rothervale Collieries, Thos. Butlin and Co., Daniel Doncaster, Martino Steel and Metal Company, United Coke and Chemicals Company, and the United Strip and Bar Mills, Sheffield. Mr. Hilton for many years held the dual position of secretary and general manager to the Birmingham Gas Department, and associated himself with the Metropolitan-Vickers Company in 1918. He is the Vice-Chairman of the Council of the British Electrical and Allied Manufacturers' Association.

IN connection with the floods of last Saturday which devastated the neighbourhood of the Thames-side wharves and streets, it is interesting to learn that, owing to the policy of the directors of the London Power Company in expediting the linking up of the several generating stations as contemplated under the London Electricity (No. 2) Act, 1925, the supply of electricity was fully maintained, notwithstanding the fact that one of the company's principal stations, namely, that at Bow, was completely inundated, thus rendering it necessary to shut down the station entirely. Further, a limited supply was given by the Power Company to the City of London Company owing to difficulties experienced at the Bankside station through the same cause. Had the stations of the London Power Company remained as they were before the passing of the Act, the inter-linking would not have been carried out, and the whole supply to the City and West End districts of the Charing Cross Company would have largely, if not completely, failed.

THE announcement is made by the Carnegie Institute of Technology, Pittsburgh, that Dr. Thomas Stockham Baker, President of the Institute, expects to spend six weeks in Europe during February, March and April to organise plans for the second International Conference on Bituminous Coal at Pittsburgh. The first Conference was held in November, 1926, under the auspices of the Carnegie Institute of Technology, and was attended by 1700 delegates and leading fuel scientists from thirteen different countries. The second Conference, which will be held under the same auspices, will take place in the week beginning November 19th next. We understand that a definite decision has been made to include the subject of "synthetic fertilisers from coal" in the programme of the second Conference. Other subjects to be considered will probably include the latest developments in obtaining light spirits from coal, power from coal, low and high-temperature distillation processes, smokeless fuel, gasification of coal, utilisation of coal tar products, and coal in relation to the production of fixed nitrogen.

SOME AEROPLANES OF 1927

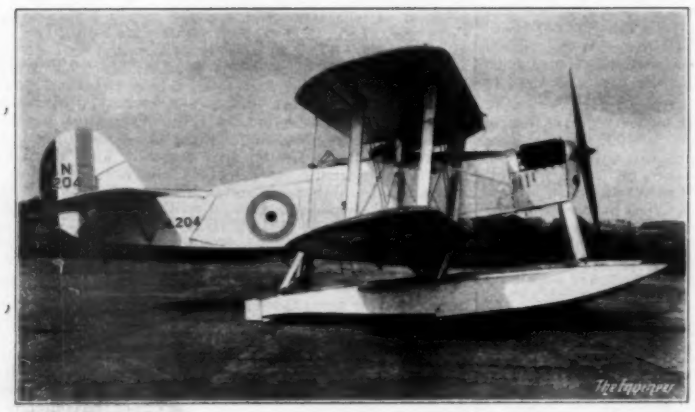
(*For description see page* 34)

AVRO AVIAN LIGHT AEROPLANE

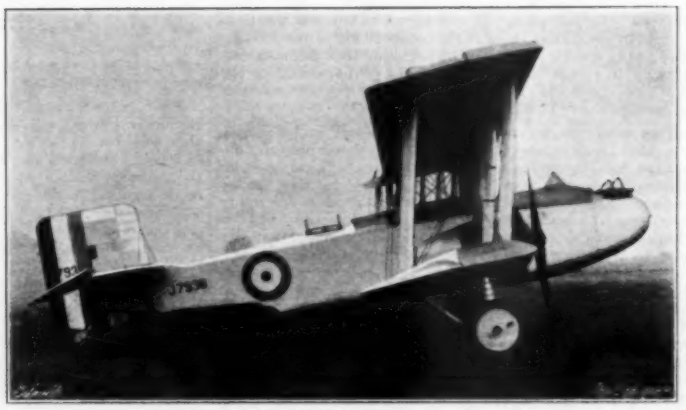
AVRO BUFFALO DECK-LANDING TORPEDO CARRIER

AVRO CIERVA AUTOGIRO

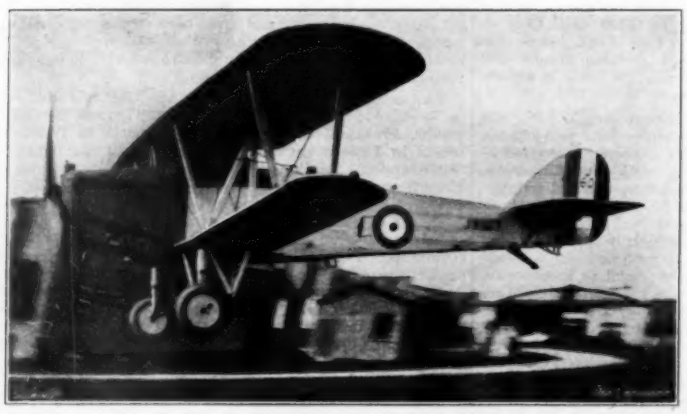
BLACKBURN BLUEBIRD LIGHT SEAPLANE



BLACKBURN RIPON TORPEDO PLANE



BOULTON AND PAUL SIDESTRAND DAY BOMBER



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THE ENGINEER.

JANUARY 13, 1928.

The Thames Flood.

IN the early morning of Saturday last the river Thames rose to a level never previously reached, with the result that it overflowed and even burst the Embankment at various points, and there was a most regrettable loss of life, principally among persons sleeping in basement rooms in houses near the river. During subsequent tides the rise in the river was considerably above normal, but, owing to the very prompt measures that had been taken by the authorities, although there was a certain amount of flooding, it was not so great as in the first instance, and there were no further fatalities. Apart from the loss of life, there has been very serious damage to property, and the whole occurrence may be properly styled calamitous. During the past week a great deal has been written and published on the matter, and there have even been attempts to fix the blame for the catastrophe on someone's shoulders. Much that has appeared in print has been irresponsible criticism founded on no solid basis of fact.

Let us for a moment consider the various circumstances which led up to the unprecedented rise in the level of the river. There were three causes which contributed to it. In the first place, there was the normal high tide which occurs at about and immediately following the period of full moon. In ordinary times that would mean a rise of some 1ft. 6in. above Trinity High Water Mark and certainly would not, of itself, cause the river to overflow. Secondly, for some days previously heavy gales had been raging in the English Channel. They had been severe enough to bring about an almost entire suspension of the cross-Channel steamship services. Now, it is a well-known fact that with a south-westerly gale blowing for long periods up Channel the tides are disorganised and the water is banked up at the foot of the North Sea. As a consequence the level of the water at the mouth of the Thames is raised and higher tides than usual are noticeable right up the river. That phenomenon, which has frequently been observed in the past, was exceptionally pronounced in the instance under consideration, and was all the more severe in its incidence because the south-westerly gale had been of long continuance. But another factor also intervened. Although the wind blew from the south-west in the Channel, in northern districts it came from the north-west and it, too, was heavy and had been blowing for days. Its effect was still further to bank up the water in the south of the North Sea, water from the Atlantic being forced round the North of Scotland and down the East Coast. The combined effect of both these causes was to elevate the level of the water in the Thames Estuary to a height greater than, as far as we are aware, had ever previously been experienced. Upstream it reached, at full flood, a point some 6ft. above the predicted level for the day in question. It was this abnormal tide which was probably entirely or almost entirely the cause of the disaster. There was, however, a still further contributory cause, though we think that it added comparatively little to the total. The snowfall of Christmas time was particularly severe and widespread, and in consequence of the thaw a very considerable volume of water was coming down the river, At Teddington Weir, at the time, the flow was, we understand, somewhere in the neighbourhood of 9,000,000,000 gallons in the twenty-four hours. But even that great volume of upland water coming down would, under normal conditions, raise the level of the river in the neighbourhood of, say, Westminster, by a matter of only a few inches; certainly by not more than 1ft. at high water. Hence, although the flooded condition of the river may have had the effect of aggravating, in some degree, the magnitude of the disaster, it cannot, we think, be looked upon as being its chief, or anything approaching its chief cause.

Suggestions as to what should be done to prevent the recurrence of such a lamentable visitation have, naturally, been forthcoming. The well-known barrage scheme, referred to by Lord Desborough, has again been brought into prominence. That plan, though it might prevent the rushes of water coming up from the North Sea from penetrating to the upper reaches of the tidal portion of the river, would have defects of its own which we do not propose to discuss at the present moment, saving to remark that its proposed site is downstream of the main sewage outfalls north and south of the river. That something will be done to minimise the effects of a possible repetition of the events of last week-end we do not doubt, but nothing short of an embankment with an entirely unbroken parapet nowhere lower or weaker than that which at present exists for by far the greater part of the length, would appear entirely to do away with all suspicion of danger. Even that might not make it absolutely sure that water, when the river was at an abnormal height, would not percolate for some distance through the permeable soil which is known to exist at several places along the river banks, or back up through the culverts which now convey the waters of the various tributaries into the river. The water gained access to the roadways in the first instance through some of the many openings which exist and, in one or two short lengths, by the destruction of old walls. In several places it ultimately surmounted the parapets. Complete protection would therefore involve raising the height of the walls throughout a great part of their length. That, we need scarcely say, would be a very serious undertaking and it is clearly the first business of the authorities to reconstruct the broken walls with stronger materials in order to prevent a recrudescence of flooding under conditions less rare than those of last week.

The French Navy.

AFTER a delay of nearly six months the French Parliament has, within the last few weeks, voted the credits for the construction of ships during the year which began on July 1st last. The total amount is 168,500,000 francs, and the vessels to be put on the stocks comprise one 10,000-ton cruiser of the "Suffren" class, six destroyers of 2400 tons of the "Tigre" class to steam at 37 knots, five first-class submarines of 1600 tons of the "Pascal" type, one submarine minelayer of 760 tons, and two despatch vessels for foreign and Colonial service of 2000 tons. While the delay in voting the credits has retarded the execution of the programme, the contracts have been prepared in the meanwhile, and the work will be put in hand at once. It is hoped by expediting the work to make up for lost time. The Minister of Marine has already prepared his plans for naval construction in the following financial year, and they will be presented to the Chamber of Deputies very shortly. A feature of this new part of the programme is the evidence it affords that the Com-

mission of the Marine has arrived at a uniformity of types. It also appears that the idea of constructing capital ships has not been definitely abandoned, although it is not intended to build any under present conditions, but France reserves to herself the right to construct capital ships up to the limit allowed by the Washington Conference if such a step should be warranted by the international situation, in which case naval architects will, it is said, endeavour to break away from old traditions and produce fighting ships of great power at less cost. For the moment the capital ship does not enter into the scheme of French naval strategy. The battle cruiser is regarded as providing all the offensive power that can be employed under modern conditions of naval warfare, where speed and rapidity of manœuvring are primary considerations, but despite the remarkable qualities of the new French cruisers it is felt in France that the smaller German ships represent an advance in design and armament, at least in some respects, that should not be overlooked. The unification of destroyers of 2400 tons and the number being constructed, point to the fact that the French Marine is depending largely upon this type of vessel, not as a destroyer but as a small cruiser. This fits in with the strategical policy of protecting sea routes with as large a number as possible of small craft, sufficiently armed to attack heavier ships, and relying for their own safety upon speed and rapidity of manœuvring. By unification such vessels can be turned out in a short time at relatively low cost. When the six destroyers of the "Tigre" class are launched France will already possess a bigger flotilla of these little cruisers than any other navy. The two despatch vessels are intended solely to keep the navy in touch with the Colonies and distant stations. They will each be propelled by two oil engines of 1500 horsepower, and everything will be done for the comfort of officers and men under conditions of extreme temperatures. They will have an exceptionally big radius of action, and each will carry a seaplane. It has also been decided to scrap the old Jeanne-d'Arc training ship and to build another of 6500 tons, which will possess much better navigating qualities and will be more appropriate for the purpose.

While every effort is being made to carry through, at fixed dates, a programme which represents the maximum that can be accomplished in the present state of national finance, the French Government considers that it is a minimum which cannot be reduced without imperilling the safety of the Colonies. The failure of the Geneva disarmament conference has strengthened the French in their belief that, unless security can precede disarmament, each country must have the right to determine what forces are necessary for its own protection. When the programme of naval construction is entirely completed in 1943, if there should be no delays meanwhile, the French navy will only possess at that date 500,000 tons of modern vessels, whereas the programme of 1912 provided for 889,000 tons. The effort now being made to reconstitute the navy is, therefore, by no means greater than is justified by the necessity of protecting the Colonies, which it is hoped to weld into one vast Empire. Following the example of some other countries the arming of merchant vessels will probably come up for discussion before long. A Bill with this object in view has already been prepared, but it provides for a State control which would necessitate its approval of all plans for the construction of merchant ships and that would certainly not be accepted. From a military point of view the French mercantile marine, although of double the tonnage that it was before the war, is much inferior to that of some other countries on account of the fewer number of modern fast ships. Hence the importance of possessing a modern fleet, capable of ensuring communication with the Colonies in case of hostilities, has impelled the Government to offer financial facilities to shipowners and certain advantages to shipbuilders. While, however, all these efforts to create a strong and homogeneous naval force are giving positive and practical results the problem of manning the ships has not been definitely solved. The source of supply from the seafaring population has fallen off, largely on account of the decline of the fishing industry off the coast of Newfoundland, and the Minister of Marine has had to establish a system of propaganda and offer special encouragement to attract men into the navy. Still more serious was the decline in the number of cadets at a time when the navy was no longer regarded as a promising profession, but during the past year or two an improvement in the conditions has had the effect of drawing a steadily increasing number of youths into the training schools. The Minister of Marine declares himself satisfied with what has already been achieved, and affirms that the recruiting of officers and men is keeping pace with the programme of naval construction.

In his report upon the naval estimates Monsieur Robaglia stated that the programme could not be carried out in its entirety unless the works necessary for naval defence were executed at the same time. The navy needs strong bases, land batteries, a good aviation service, not only at home but in the Colonies, and it was declared that this backing of the navy was much neglected. In building up the navy not enough has been done for coast defence. Special reference was made to Toulon, which is regarded as a vital point in the naval strength. During the debate there was no concealment of the French anxiety at the growth of the Italian navy and at the Italian claims to certain advantages in North Africa. There is admittedly a struggle for supremacy, and the French know that the existence of their vast Colonial Empire in Africa depends upon their being able to maintain a perfectly safe sea route across the Mediterranean. The present competition in naval armaments may be avoided by an understanding between the two countries, which is rendered possible by the negotiations that both desire to entertain with a view to settling upon a definite status in that sea. France maintains a right of control over the western part of the Mediterranean, which it may be difficult to establish except by a superior naval force. She hopes to accomplish it with the aid of cruisers and a specially strong flotilla of well-armed destroyers and submarines and an adequate air force which will keep the sea route open between Marseilles and North Africa. The Colonial Empire, or, rather, that part of it which alone counts in the scheme of national defence, is linked up with France by this one sea chain, and if it were broken the whole existence of the Empire would be imperilled. It is this necessity which is the guiding factor in the preparation of the programme of naval construction, and it explains why France can accept no reduction of armament in the way of cruisers and light surface craft and submarines unless she is first assured of security.

Obituary.

LEON GASTER.

ALTHOUGH he was by profession and training a journalist, Mr. Leon Gaster, whose death occurred on Saturday last at the age of fifty-five, became associated with engineers owing to the close study he made of the problems of illumination, a subject in which he was recognised as an expert. His father was in the Dutch Diplomatic Service, and throughout his youth Leon Gaster lived in Rumania. Some twenty-five years or so ago he came to this country to practise as a technical journalist, and gradually acquired a pronounced interest in illumination. He was honorary secretary of the Illuminating Engineers' Society, which, we believe, he was instrumental in founding, and he owned and edited *The Illuminating Engineer*. A man of great energy, he took a prominent place in the work of the Institute of Journalists, of which he was a Fellow, and was associated with the National Safety First movement. He rejoiced in committees, and was never happier than when arranging congresses and reunions of all kinds.

ROBERT BRIDGE.

MR. ROBERT BRIDGE, whose death occurred recently at the age of sixty-three, was chairman and managing director of the firm of David Bridge and Co., Ltd., Castleton, Manchester. At a very early age Mr. Bridge commenced work in a foundry owned by his father. Afterwards he spent some time in a paper mill and a cotton mill. He was next employed by a firm of engineers in Lancashire until in 1896 his father, Mr. David Bridge, commenced business in Salford, making the well-known Heywood and Bridge friction clutch. Chiefly owing to Mr. Robert Bridge's efforts the business developed steadily, and in 1900 it was found necessary to build the present works at Castleton. During the intervening period other specialities were taken up by the firm, including rubber machinery, both for planters and manufacturers, cable and wire-drawing machinery, cotton baling presses, haulage mechanism for mines and millwright work. Mr. Bridge was a member of the Institution of Mechanical Engineers.

Literature.

Armaments and the Non-combatant. By E. F. SPANNER. London: Williams and Norgate. 1927. 12s. 6d. net.

THE author of this book, himself a naval architect and an engineer of ripe experience, sets out to prove that our existing system of first-line defence, based as it is upon the great ship, is fundamentally at fault. For the battleship and other heavy surface vessels he would substitute aircraft, manned by *personnel* drawn from the Navy. Only by effecting this drastic change shall we be able, he contends, to ward off the menace of overwhelming air invasion in a future war. In Mr. Spanner's case familiarity with the battleship has bred profound contempt. His criticisms of its vulnerability and its restricted mobility deserve notice if only because they are expressed by one who has had practical experience—as a former member of the Royal Corps of Naval Constructors—in the design and construction of modern warships. It is, however, no news that the largest battleship is liable to be disabled by sub-surface explosions. This particular danger has had to be faced ever since the introduction of mines and torpedoes. That it has been greatly accentuated by the coming of aircraft remains to be proved.

In our opinion Mr. Spanner exaggerates the aggresive powers of aircraft against battleships. The experiments which have been carried out to date, so far as the results are publicly known, lend no colour to the theory that aeroplanes, whether using bombs or torpedoes, are capable of denying the seas to heavy surface ships. In dwelling first upon the extreme fragility of the battleship's skin below the armour belt, and then upon the devastating effect of a bomb or torpedo explosion at this point, the author is merely repeating the stock arguments of the torpedo enthusiasts of the 'eighties. The fact remains that during the Great War, in which torpedo craft of every description were very prominent, very few battleships of modern design were disabled by means of underwater attack. Whether that form of aggression would be more dangerous when practised by torpedo or mine-dropping aircraft is a question which does not, at present, admit of positive answer.

Mr. Spanner is very severe on the big naval gun, which he affects to dismiss as a thoroughly inefficient weapon. While agreeing that firing at very long range does mean a low percentage of hits, we cannot forget that of the eight armoured ships sunk at Jutland, seven were destroyed by gunfire and only one by torpedo. Perhaps the most valuable chapters in the book are those in which the air menace to our great commercial ports is foreshadowed. This danger is undoubtedly a serious one, and the author has done a national service in drawing attention to it. In so far as his object is to promote a more adequate measure of defence against invasion from the air, we are heartily in sympathy with him.

SHORT NOTICES.

Plastering, Plain and Decorative. By William Millar. Edited and remodelled by George P. Bankart. Fourth edition, revised and enlarged. London: B. T. Batsford, Ltd. 1927. Price 30s.—Millar's "Plastering" has been for so long honourably known that it seems scarcely necessary to say much concerning this, its fourth, edition. Yet we may recall that Millar was himself a practical plasterer, fully apprenticed to the trade and an enthusiastic worker in it all his life. The story of his famous work is romantic. He began it in 1880 as a young man, and for years laboured at it whilst pursuing his craft at home and abroad. When the MS. and drawings were practically complete they were all destroyed in a fire at his house. He set to work again undaunted; re-wrote the text and made new drawings. He then succeeded in finding a publisher, only to suffer disappointment once more by the failure of the firm. Hence it was 1897 before the volume appeared. At that period the art and craft of plastering was not at a high level, but it is the belief of the present editor that a revival has come about. If it has indeed done so, no better volume could be found for the instruction of craftsmen and artists than this book of Millar's. It is not only inspired by artistic feeling, but it is thoroughly practical throughout, and Mr. Bankart has added several useful sections to bring it fully up to date. The publisher's work is up to their usual high standard. The text is clear and the illustrations admirable.

BOOKS RECEIVED.

Technique de l'Etirage: Etude Générale. By G. de Lattre. Paris (IXe): "L'Usine," 15, Rue Bleue. Price 38f. net.

Builders' Bookkeeping and Costing. By C. G. Dobson. London: Oxford University Press, Falcon-square, E.C. 1. Price 8s. 6d. net.

Ice and Cold Storage Trades Directory, 1928. London: Iliffe and Sons, Ltd., Dorset House, Tudor-street, E.C. 4. Price 10s. 6d. net.

Calvert's Mechanics' Almanack, 1928. Edited by F. Nasmith. London: John Heywood, Ltd., 20, St. Bride-street, E.C. 4. Price 6d. net.

All the World's Aircraft, 1927. Edited by C. G. Grey. London: Sampson Low, Marston and Co., Ltd., 100, Southwark-street, S.E. 1. Price 42s. net.

The Theory of Emulsions and their Technical Treatment. Second edition. By W. Clayton, D.Sc. London: J. and A. Churchill, 40, Gloucester-place, W. 1. Price 15s. net.

Annali dei Lavori Pubblici (già Giornale del Genio Civile). Ministero dei Lavori Pubblici, Consiglio Superiore, 1927, Ottobre. Rome: Provveditorato Generale dello Stato Libreria.

Grandi Utilizzazioni Idrauliche. Per Forza Motrice. Elenco degli impianti in funzione e in costruzione. Vol. II., Situazione al 31 dicembre, 1926. Rome: Provveditorato Generale dello Stato Libreria. 1927.

A.S.T.M. Standards, 1927. *Part I., Metals; Part II., Non-metallic Materials.* Philadelphia: The American Society for Testing Materials, 1315, Spruce-street. Price: Part I., 7·50 dollars; Part II., 7·50 dollars.

Electrical Engineering in 1927.

No. II.*

Research.

Most of the year's work of the Electrical Research Association has not yet reached the report stage. The Association has, however, in preparation a series of critical *résumés* of information and theories on the nature of dielectrics, with particular reference ot the failure of insulating properties. The first, on discharges in gases, has been published; a volume dealing with liquids is in the press; whilst a third, the most important, relating to solids, is in an advance stage of preparation. Arising out of this study, the Association is preparing programmes of fundamental research. Further progress was made by Mr. L. Hartshorn at the National Physical Laboratory in the study of Schweidler's laws of dielectric loss and dielectric absorption under conditions of varying humidity and temperature.

It is known that there are dielectric losses at the surface of contact between metal parts and insulators, even where the contact is obtained by the use of mercury, graphite or other materials giving intimate contact. This phenomena is being studied in co-operation with the Metropolitan-Vickers Company, and a valuable report has been prepared by the investigators. The theory of pyro-electric breakdown in relation to thermal instability received considerable attention, for it is recognised that probably the majority of breakdowns of high-voltage insulation is the result of cumulative heating arising from dielectric losses, rather than from inability to withstand even considerable excess voltage stresses at the normal working temperature. This matter is explained in a popular way in a report about to be issued. With the assistance of Professor C. L. Fortescue, a preliminary investigation of the phenomena known as "Corona" in oil was carried out by Mr. R. W. Plumbly at the City and Guilds Engineering College. The study of the sphere gap as a device for measuring high voltages with a view to its more accurate calibration led to an exhaustive examination of available standards of high voltage. The International Electro-technical Commission has accepted tentatively the 20 mm. sphere gap calibration put forward by the Association, and, having endorsed recommendations for further research, steps are being taken to carry out additional experimental and theoretical work. In view of the fact that there is little published data on the thermal resistivity of dielectrics, observations were made in this connection under typical working conditions, and a report on this work will shortly be available. Another report deals with the use and limitations of the various forms of cathode ray oscillographs. Work in connection with fibrous insulating materials, varnishes and compounds was directed to the improvement of materials in manufacture and the preparation of specifications for their purchase.

A report of the numerous researches made on vulcanised fibre, which led up to the issue of a British Standard Specification, was issued. In the past the fabrics and papers used as a basis for supporting insulating varnishes and compounds have been those made for other commercial purposes, such, for example, as cotton cloth, but specially selected for the uses of the electrical engineer. These fabrics have been studied by the Electrical Research Association for a number of years. The main features of importance have probably now been established, and the way is open for improvement in the selection of materials and the details of the technique of manufacture. Experimental materials having superior properties have been developed, and specifications are being drafted for purchasing purposes. Asbestos yarn and paper received special attention. A comprehensive report is in preparation on the use of natural and artificial silk in insulation.

Several years ago the Electrical Research Association issued a report on methods of study applicable to hard composite dielectrics. A demand has now arisen for purchasing-specifications for a variety of such materials, and at the request of the British Electrical Standards Association, the Electrical Research Association has reopened the subject. Experiments are being made with a view to the discovery of surfaces able to resist deterioration by exposure, and especially by the deposit of impurities. In co-operation with the British Engineering Standards Association and the International Electro-technical Commission, the Electrical Research Association is studying the various methods of gauging the ageing characteristics of insulating oils with a view, for example, to the improvement and simplification of sludge tests.

As in previous years, research work was undertaken by the Association on the heating of cables. In the past it was shown that, in practice, there was a considerable discrepancy between temperature rises observed and those calculated on the basis of the best available methods of estimating the thermal resistivity of the soil. To cover this discrepancy a correction factor was used, and it was found to meet the case within the limits of the range of experimental tests made, but there was no explanation to account for this large correction factor or even for its sign. The problem is, however, now being looked into. Experimental work on a large scale is being planned and methods of testing thermal resistivity of the soil *in situ* are being investigated. Where a number of cables are laid in ducts there is likely to be considerable mutual heating. In one case an empty duct was found to have an initial temperature of 35 deg. Cent., derived from surrounding cables. Methods of estimating the thermal resistivity of the ducts walls have been given by the Association, but the problem of arriving at the thermal resistivity between the individual cables and the duct wall surfaces is not so simple and has not yet been solved. In the development and use of cables at voltages above 11,000, dielectric losses become a controlling feature, and although their study presents considerable technical difficulties, good progress was made in that direction by Dr. E. H. Rayner at the National Physical Laboratory. Further research in hand covers three-phase measurements.

An important research was completed on the design of foundations for poles and towers for overhead lines. Methods were devised for measuring the actual pressure on different parts of the foundations of scale model poles erected in sand and in clay, and of testing the properties of a given soil. Work on wind pressure is held up by lack of funds. Research at the Carville power station led to the development of new and promising types of circuit breakers which are said to show marked advantages as regards reliability, energy released, and wear and tear. In all probability a report on this work will be presented to the Institution of Electrical Engineers in the near future. In co-operation with the Safety in Mines Research Board, more work was done on the design of flame-proof apparatus, and a confidential report was issued to manufacturers. Extensive tests were made at Stonebridge Park on the performance of British standard ordinary duty fusible cut-outs. At the request of the British Engineering Standards Association, the Electrical Research Association made certain investigations with a view to throwing light on the performance of electric control apparatus under service conditions. The issue of a report of evidence bearing on clearances employed in high-tension switchgear with additional information on clearances specified by various authorities enabled the British Engineering Standards Association to obtain agreement on figures appropriate for a British standard specification. A report on the deterioration of electric strength of the atmosphere in switch cubicles, &c., shows that the probable effects of deterioration by ionisation, by smoke fumes, &c., has been over-estimated.

The conditions to be met by a modern steam condenser are becoming increasingly severe, and, to meet the requirements with certainty and without excessive factors of safety, research was necessary to establish heat transmission coefficients for modern conditions. This was organised under the direction of Professor Stoney, and following a critical study of available data and mathematical methods, Messrs. A. Eagle and R. M. Ferguson completed a report giving experimental determinations applying to ¾in. tubes. To provide reliable data for the designer of steam turbines under the high pressures and temperatures now in use and in contemplation, it was necessary to devise novel experimental methods of determining the properties of steam. This work was carried out by Professor Callendar in co-operation with the Electrical Research Association, and revised tables were published covering part of the range. Some account of this work was given in a lecture by Professor Callendar before the Society of Arts, whilst the Electrical Research Association has issued a report on the direct measurement of the total heat of steam up to 1000 lb. per square inch. Apparatus was devised and tested for much higher pressures. The profitable researches on steam nozzles by Professor Stoney, in which the Electrical Research Association has been co-operating with the Institution of Electrical Engineers, are being continued under Professor Petrie, and a fourth report was issued to interested manufacturers. A confidential report was also issued to manufacturers on certain experimental observations carried out by Professor Callendar on temperature and pressure distribution in the various stages of steam turbines. The Electrical Research Association is now preparing a comprehensive report on available data on telephone interference arising from power distribution systems and allied phenomena. Other researches have been carried out or are in hand by the Electrical Research Association, but we must now turn to some of the work of the General Electric and Metropolitan-Vickers Electrical Companies.

At the Wembley laboratories interesting work was done in connection with photo-electric cells. A rating machine for electric lamps employing these cells in place of the human eye was mentioned in our notes last year. This machine has now been made fully automatic and sufficiently robust for use in a factory. In its present form it enables one unskilled worker to examine lamps at the rate of 380 per hour and to determine whether they fall within agreed voltage limits. New methods were devised for the measurement of very small illuminations with simple apparatus and for the control of radio frequency oscillations by means of light. A new photo-electric cell was produced which is much more sensitive to the red end of the spectrum than any other photo-electric cell available. In connection with searchlights, the spectrum of high-current carbon arcs was studied and results of considerable scientific importance were arrived at. Progress was made in the development of small switches, which may prove useful under exacting conditions of service. The contacts are enclosed in a highly evacuated tube, thus preventing arcing and oxidation. A novel laboratory method was devised for studying the attack of molten glass on furnace refractories. Small-scale models of refractory blocks were made up and materials, such as waxes, were used as binders, whilst the glass was replaced by organic solvents. By means of suitable combinations of binders and solvents a close picture of the actual conditions of solution in a furnace can be obtained.

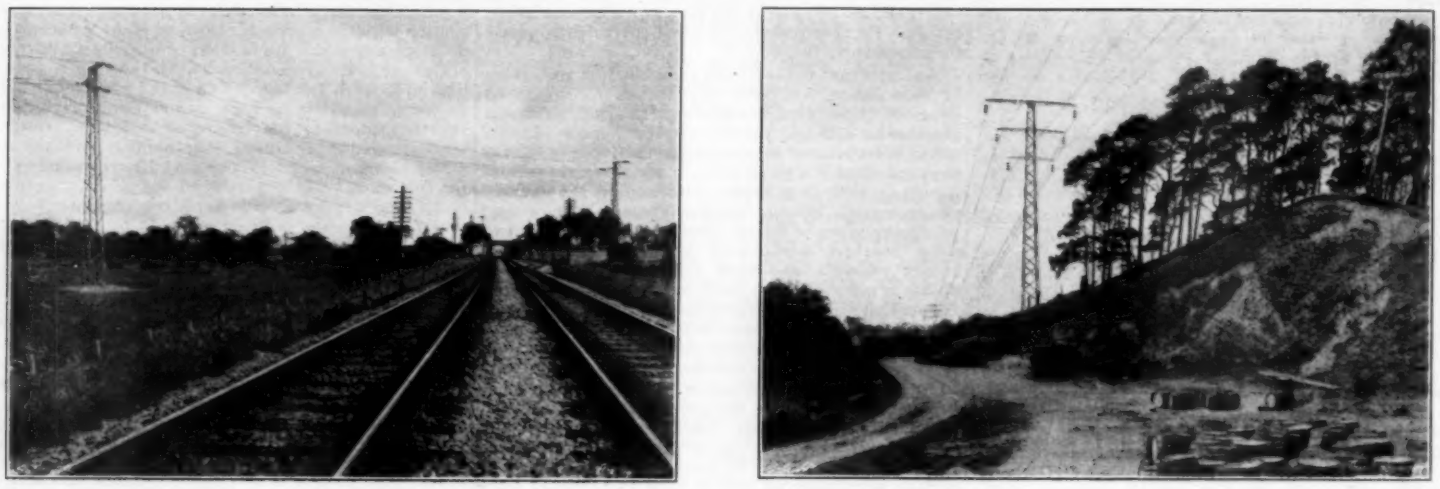
Coming now to the Metropolitan-Vickers Electrical Company's research department, in connection with the testing of electrical plant, a successful development is the application of alternating-current bridge methods of measurement (hitherto practically limited to high frequency and standardisation work) to power apparatus and even to rotating machinery. Investigation into the failure of metals by fatigue was extended to the testing of actual parts of machines under alternating stresses caused by vibration, and by this means the influence of manufacturing processes and peculiarities in form are correctly represented. Attention is being given to the influence of surface condition upon the failure of metals under constant and variable stress at atmospheric and higher temperatures. An important investigation into the resistance to corrosion of light alloys under conditions representing different kinds of service has given results which have been correlated with the composition of the alloys. A process of chromium plating—the only process, it is claimed, at present commercially successful—was developed. It is capable of giving a hard coating to articles such as pump valves, which are subject to heavy wear, and to moulds for various compositions, and even for glass. The process is also applied to new dies and to old dies for the purpose of taking up wear. In connection with investigations on the preparation and working of rare metals, the company's research department installed a rolling mill capable of producing extremely thin sheets of metal. Copper sheet has been produced with a thickness of not more than ·003 mm. An important application is the rolling of molybdenum, which can be prepared in sheets up to 6in. wide, 3ft. 6in. long, and down to ·07 mm. in thickness. A considerable amount of work is being done on a mill for users of the material, this mill being claimed to be the only one capable of carrying out work of this nature.

Switchgear.

Every year a large quantity of switchgear is constructed, and within recent times the output of outdoor gear has greatly increased. Details of many large and important switchgear contracts have reached us, but limitations of space will not allow us to deal with them. In anticipation of the Government's schemes, the English Electric Company paid considerable attention to outdoor gear, which can be supplied for any pressure up to 220 kV. For lower pressures outdoor equipment is now very frequently employed. A large quantity of 22 kV outdoor gear was made by this firm for Athens, and at the present time the company is constructing 66 kV and 33 kV outdoor sub-stations at the ends of the supply line from Preston to Blackpool, and for ultimately controlling 30,000 kVA of transforming plant. Design work on indoor switchgear related mainly to super-power station gear. New designs were got out by the English Electric Company for metal-clad compound filled switchgear, and for super-power station layouts combining the principles of compound-filled gear with the ordinary cubicle type layout, a scheme which enables the engineers to inspect the isolating switch contacts and their working, whilst at the same time each piece of apparatus is essentially ironclad without intervening bare connections. The gear is suitable for indoor or outdoor use, and lends itself to phase separation. The latest addition to the company's truck type switchgear is a large sized truck accommodating three single-pole oil circuit breakers having a rupturing capacity of 250,000 kVA and a large margin of safety over the standard clearances for 11,000 volts. A novel form of isolated phase switchgear was developed by the British Thomson-Houston Company. It is intended to meet the onerous conditions demanded by the highest voltages associated with the largest power stations contemplated in this country. The arrangement permits the use of an unusually small number of parts, and insulators of the outdoor petticoat type, whilst those on the breaker itself are of the shedded type, so that a minimum amount of clearance is necessary. As the isolating switches are of the carriage type and are electrically operated, access to the gear is only necessary for maintenance work. The switchgear is contained in a building, and a concrete room accommodates the circuit breaker and potential transformer, so that in the unlikely event of an oil fire the free oil fumes cannot gain access to the live metal. The room is provided with a gravel catch pit to prevent combustion and a drainage system carries away the oil. If it is desired to avoid the cost of a containing building, the equipment may be used outdoors. The

* No. I. appeared January 6th.

progressive development of B.T.H. truck type switchgear is exemplified in the design of a switch board with oil circuit breakers having a rupturing capacity of 250,000 kVA, and suitable for a working pressure of 11,000 volts. The bus-bar connections are totally enclosed in insulating tubing, notwithstanding that the standard air clearances needed for 11,000-volt working are maintained. Potential transformers are being developed in the B.T.H. works, with the limiting resistance incorporated as part of the transformer, either in the brushing or under the oil, and for the higher voltages the fuse is also mounted in the transformer tank. Cellulose enamelled sheet steel control panels are now advocated by this company, whilst for duty where steel is not suitable "Sindanyo" (ebony asbestos) is now supplied in place of black enamelled slate or marble. The new switchgear introduced by the B.T.H. Company during the past twelve months has been designed to meet the thermal effects and heavy magnetic stresses associated with the increased short-circuit duties arising from the larger outputs of power stations and the interconnection of undertakings under the national grid scheme. The Metropolitan Vickers Electrical Company extended its range of type K metal-clad switchgear for indoor power station service. Circuit breakers having a rupturing capacity of 1,500,000 kVA are being built. The first contract includes twelve units for the Portobello Power Station of the Edinburgh Corporation. The bus-bar selector switches and feeder isolating switches will be electrically operated in addition to the main circuit breakers, with the result that the complete control of all switches will be carried out by one operator at the control board.



SHANNON POWER SCHEME—38 kV TRANSMISSION LINES

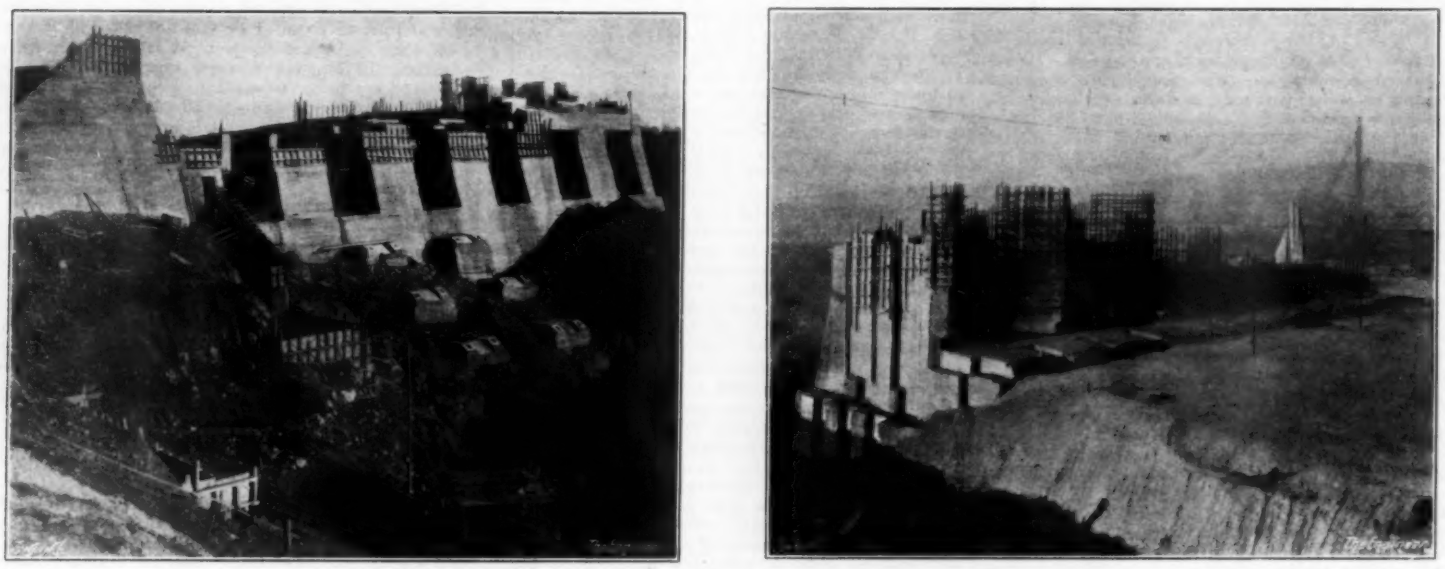
Electric Traction.

Automatic control gear for traction sub-station plant is now one of the main products of the large electrical manufacturing concerns. The General Electric Company, the British Thomson-Houston Company, the Metropolitan-Vickers Company and Crompton, Parkinson, Ltd., all appear to have carried out a considerable amount of work of this nature, that of the latter firm apparently relating mainly to automatic gear associated with sub-stations for public electricity suppliers. For traction work British manufacturers adhere rigidly to the direct-current system, whilst for general supply purposes alternating current is rapidly gaining ground. One of the most important traction contracts secured by the British Thomson-Houston Company was for the complete sub-station and track sectioning equipment for the electrification of the main lines of the Indian State Railways from Bombay to Igatpuri and from Bombay to Poona. The sub-stations will contain fifty-two rotary converters, and about one-half of these sub-stations will be semi-automatic, whilst the remainder will be operated by supervisory control apparatus. Early in the year the General Electric Company published particulars of some interesting automatic traction sub-station gear constructed for the South African Railways. Another automatic sub-station contract carried out by the firm was that for Sutton Coldfield. A record in the size of British-built electric locomotives is being established by the Metropolitan-Vickers Electrical Company, which is constructing forty-one 2600 horse-power 120-ton engines for heavy goods service on the Great Indian Peninsula Railway. One complete locomotive was assembled, tested and dispatched, with five other complete equipments, for erection in India. A 2160 horse-power high-speed passenger locomotive was also built by this firm for the same railway. For the Sydney suburban railways the Metropolitan-Vickers Electrical Company is supplying 105 motor coach equipments and 100 trailer coach equipments, similar to equipments previously supplied. Each motor coach is being fitted with two 360 horse-power motors, which are probably the most powerful individual motors that have been installed on multiple unit trains. Other electric railway equipment is being supplied by the Metropolitan-Vickers Electrical Company to Holland and Spain, and electric tramway equipment to Glasgow, Sheffield, Melbourne, and Brazil.

The English Electric Company built a new railless electric trolley omnibus, which is now in service. It is driven by a 64 horse-power motor controlled by a foot-operated controller. With a view to obtaining the lowest possible weight per horse-power, and the largest ground clearance, even in the case of vehicles fitted with wheels as small as 26in. in diameter, the English Electric Company introduced a new range of tramway motors. The company also designed a worm drive for electric tramcars, and a new bow current collector, which has been tested for a long period on a large tramway system in this country.

Electric Motors.

According to reports, there was a marked increase in the demand for high power factor motors, such as auto-synchronous and "Tru-watt" motors. The demand for Crompton-Parkinson machines of these types is said to have been greater than in any previous year. Among the large induction motors built by the Metropolitan-Vickers Electrical Company were three 8000 horse-power machines, each coupled to two direct-current generators for electrolytic work. A new range of Metro-Vick self-contained synchronous induction motors of the end-shield pattern, with outputs ranging from 150 to 600 horse-power, was introduced. The slip rings are mounted inside the case and the exciter yoke is supported on the end shield, whilst the exciter armature is overhung from the main bearing. Squirrel-cage induction motors, which at one time had the disadvantages of low starting torque and high starting current, are now widely employed for work that involves a good starting effort, and, as was shown in the article on "Improved Electric Motors," which appeared in our issue of July 22nd, 1927, modern motors of this type may be employed for many purposes for which slip ring motors originally had to be used. For central station work, the size of the squirrel-cage motors continues to increase. Two Metro-Vick central station machines were constructed for outputs of 565 and 440 horse-power. Another interesting squirrel-cage motor contract carried out by this company was for four two-speed machines for driving central station centrifugal pumps, and for developing 400 horse-power at 485 revolutions per minute and 125 horse-power at 325 revolutions per minute. A



SHANNON POWER SCHEME—CONCRETE WORK AT GENERATING STATION SITE

motor for operating underground conveyors was introduced by Bruce Peebles and Co., Ltd. These squirrel-cage totally enclosed flame-proof machines have been designed to meet limitations in height and weight, and to withstand the same operating conditions associated with the handling of coal. They are fitted with ball and roller bearings, and a flame-proof triple-pole starting switch or a trifurcating box for armoured cable, according to the customer's requirements.

Miscellaneous.

Any attempt to review twelve months' progress in electrical engineering in a few columns of THE ENGINEER must of necessity fall lamentably short of actualities, but some of the most important events of the year have been dealt with. As usual, the electrical manufacturers have sent us long accounts of the work they carried out, and, although we cannot describe it fully, before bringing this article to a close, we will touch upon one or two other items of interest.

The erection of small stations has been sanctioned in various parts, where no bulk supply is at present available, and Crompton, Parkinson, Ltd., report that during the year new stations were completed at Newhaven, Seaford, Alton, Brightlingsea, Brecon, Liskeard, Littlehampton, and in various parts of Ireland. If space permitted much might be written concerning the application during the year of electricity in various industries, such as the mining, iron and steel, and textile industries. From the Metropolitan-Vickers Company we have received detailed accounts of work of this nature, but limitations of space will not allow us to deal with them. Orders for converting plant appear to have been as plentiful as ever. Rotary converters and motor converters were made for large outputs. Although it has often been shown that conversion adds appreciably to the cost of electricity, there appears to be no inclination on the part of certain electricity supply undertakings to avoid the practice of continuing to supply direct current. Both the British Thomson-Houston Company and the Metropolitan-Vickers Electrical Company introduced new systems of protection. The "Translay" system, introduced by the latter firm, is claimed to be a marked advance on the older systems of relay protection. Although it involves the use of pilot wires, it is capable of working with wires of very high resistance, and the relays will not operate with any capacity current that may flow through the capacity of the pilot cable. At the same time, it is said to be possible to obtain settings substantially lower than can be obtained with any other form of pilot wire protection. The system may be employed for the protection of parallel feeders as well as single feeders. New forms of protective gear introduced by the British Thomson-Houston Company are said to be capable of affording sensitive protection on lines up to 60 miles long, and are stable on through short circuits up to 1 to 1½ million kVA at a pressure of 132,000 volts.

An interesting development was the application of high candle-power electric lamps with automatic control to lighthouses and lightships round the coast of Great Britain. The Osram lamps employed are rated in some cases at no less than 4 kW. As the filaments operate at 80 volts the current taken by a 4-kW lamp is 50 ampères, and each of the lead-in wires has a cross section of $^1/_{20}$ square inch. These high candle-power lamps can, of course, be run practically without attention, but the failure of a lamp or of the current supply was a contingency that had to be considered. Trinity House overcame the difficulty by employing two electric lamps and a stand-by emergency acetylene light, each capable of replacing the other. As the source of illumination must occupy a definite focal position in the lenses, it is necessary, in the event of a filament failing, to remove the faulty lamp and to bring another lamp into the focal position, and this is done by means of a turntable on which the electric lamps and the emergency acetylene burner are mounted. In the event of one of the electric lamps failing, the other is brought into focus by the automatic rotation of the turntable, and if the current should fail, or should both electric lamps fail, the acetylene burner swings into focus and supplies the light. All the automatic control gear and electric lamps associated with the scheme were supplied by the General Electric Company. As regards developments in electric lighting generally, notable among the many devices employed to eliminate glare are the new Pearl Osram lamps, which, although first put upon the market in this country in 1926, were not widely adopted until 1927. Intensities of illumination which some years ago would have been considered fantastic are now commonly adopted, largely as the result of improvements in lamps and devices to eliminate glare.

Another notable event of the year was the adoption for the first time of the turbo-electric drive on a twin-screw passenger ship sailing under the British Flag. This is a new 23,000-ton 17,000 shaft horse-power steamship, that is being built by Alexander Stephen and Sons, Glasgow, for the P. and O. Steam Navigation Company. The propelling machinery will consists of B.T.H. variable speed turbo alternators, driving synchronous motors coupled to the propeller shafts. A tanker for the Atlantic Refining Company, U.S.A., is being fitted by the B.T.H. Company with Diesel electric propelling equipment giving a shaft horse-power of 2800. This is a 13,000-ton vessel 500ft. long. Among other marine electrical equipment was that for the quadruple screw motor passenger liner Bermuda. This equipment was constructed by the General Electric Company, which, we understand, was also responsible for much of the work described in Mr. William McLelland's paper on "The Application of Electricity in Warships," read before the Institution of Electrical Engineers in March of last year.

For the most part we have confined ourselves to electrical work carried out in this country, but, needless to say, a great deal was done in many parts of the world. An interesting undertaking is that of the Shannon power scheme, which we have recently described, and with which we shall deal again in the near future. During the year good progress was made with the civil engineering work, and as the illustrations on page 50 show the work at the power-house site is fairly well advanced. Good progress was also made in connection with the erection of transmission lines, which are becoming conspicuous in many parts of Ireland. Examples of these lines are shown on page 50. Ultimately the hydro-electric station will have a capacity of 180,000 H.P., although the initial capacity will only be 90,000 H.P. The total expenditure is estimated at £5,200,000, of which about £2,500,000 will be spent on civil constructional works, £184,000 on mechanical plant, and £1,770,000 on electrical plant, &c., including all transmission lines. The remaining capital is needed to pay interest on the money whilst the work is being carried out, and to meet deficiencies during the first two years.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

AMERICAN v. BRITISH LOCOMOTIVES FOR S. AFRICA.

SIR,—Your leader of December 16th emphasises that price is the most important and final factor in placing orders, and your special correspondent (on page 677), in a statement which we need not doubt, emphasises the fair intention of the Board which has to decide.

But I submit that apart altogether from any question of currency exchanges, or claims by the home country for special consideration on account of her war burdens, comparisons on a simple price basis are fair only so long as standards of workmanship, fit and finish are the same.

In regard to design, the circulation by railway companies and consulting engineers of "as made" drawings has made it possible for the builders of one country to follow the designs of another when so desired by the purchasers. Whether it is "fair" to buy an experimental engine of a very special type embodying the concentrated thought and experience of a particular builder, and, after finding it successful, to broadcast the drawings to other builders and then place the order with the lowest bidder, is perhaps as much an ethical as an economic question. It seems to be a practice peculiar to railway companies, and in some aspects does not appear to offer due encouragement to the "producers" of special designs.

But standards of workmanship cannot be transmitted by "as made" drawings, and, even supposing identical design, the fact remains that, at any rate in the past, purchasers of American-built locomotives have accepted workmanship, fit and finish which their consulting engineers and inspectors would have summarily rejected at home. For this reason alone, and with the best will in the world, the decision of Colonial, Indian and Dominion railway boards which have been based solely on price have not been fair, and such decisions to-day are probably still unfair to the British builders.

And the South African Board of all should know by this time that a low first cost may involve substantial working losses of which not all are recoverable from the contractor. Your readers have only to refer to the official report published in the South African papers two or three years ago to find that buying locomotives in the cheapest market is not necessarily an economical policy.

In regard to design, one might suppose from recent articles on the South African railways that, apart from articulated types, it has been left to American builders to produce the first successful type to suit local conditions, and the excellent work of a former C.M.E. in this respect is completely ignored. I refer to Mr. D. A. Hendrie, of whose complete and exceptional grasp of essentials in locomotive design I have the happiest personal experience and recollection, and I feel sure that other designers have produced no better solution than his would have been for a given problem in steam locomotive traction.

As for such features of American practice as grease lubrication I would remark that this requires—or perhaps I should say is inevitable with—loose working fits which would not be tolerated in new work at home. A distinguished locomotive engineer has recently stated that American locomotives when new have working clearances which would bring an engine on a home railway into the shops for attention, and statements have recently been published that the finish and workmanship of the G.W.R. locomotive at Baltimore appeared to American observers as more suitable to "automobiles" than to railway locomotives.

Yet this is, speaking generally, the finish and fit expected of the British builder, whether for home or overseas, and while such different standards prevail, no comparison based on buying price alone can be fair. If, in short, overseas railways will accept what I would venture to call a grease-lubrication standard of work and maintenance from one builder, they should not expect an oil-lubrication standard from another at the same price.

Bath, December 29th, 1927. J. G. H. WARREN.

P.S.—Since writing the above I have read the paragraph on "Excessive Engine Repairs," on page 746 in your issue December 30th—a striking confirmation of my contention. I have also found, and send for your information, extracts published in 1922 from a report by the Auditor-General of the South African Railways.

The brief allusion by your special correspondent on page 678 of your issue December 16th to some troubles with steel castings, gives a quite inadequate impression of the state of affairs revealed by the Auditor-General's report. He lays a damning indictment against a large number of American locomotives, on the grounds of heavy direct and indirect losses to the Railway Administration owing to defects in these engines.

The facts show that comparisons between British and American offers which are based on selling price are both unfair to the builders and unsound for the buyers, because they relate to different classes of articles; and to place orders on a price basis alone is, in effect, to penalise British makers for their higher standard of workmanship.

The reasons for the different standards prevailing in the two countries are fundamental, but beyond the scope of this letter.

January 3rd, 1928. J. G. H. W.

CHEAP POWER.

SIR,—The interesting account of the use of sewer gas for power development in Birmingham recalls the fact that a Humphrey gas pump was similarly operated in Madras some years ago with success, and suggests also that this useful but neglected type of prime mover might be economically employed for pumping screened sewage, which I think is not beyond the capacity of properly designed valves to deal with.

For some unaccountable reason this useful British invention would appear to frighten our manufacturers despite the fact that for fifteen years a plant of this type has been showing reliable efficiency that compares favourably with Diesel engine pumping combinations at half their capital cost; that perhaps is the most amazing part of this neglect.

One, of course, knows that the Humphrey Pump and Power Company, Ltd., went into liquidation soon after the war, and one assumes that any financial loss may be erroneously taken as bearing on the technical side of the business, but the war in this instance so chanced to hit the business that it was knocked down at the very moment it was gaining recognition, not only at home but abroad also; the development of the oil engine during and after the war has, of course, set a fashion, and there is also the limitation of the system to large plant, low lift, and heavy output.

If, however, we examine the conditions of many of our most recent irrigation schemes within the Empire, we shall find that they would be pre-eminently filled by the application of the gas pump, which has been simplified and improved as well as cheapened since the most notable installations were put down. Continental competition is hitting us very hard, and we have here an answer to it. I submit that it would pay our British pump makers to abandon too conservative an attitude to a proved success, and to inquire at first hand as to the performance of these pumps with a view to their adoption where suited within the Empire.

Irrigation is probably the first factor in development after emigration, where it can be effected at low capital cost on indigenous waste fuel; in many cases is it not suicidal to neglect the facilities offered? But of gas pumps as of the "Tanks" in the war, there is a "hush-hush" policy, since it is not due to technical disability as now substantially proved, is it due to the suppression by vested interests, and, if so, would not a wider outlook be generally more helpful in the long run with our trade in its present state?

January 9th, 1928. "GAS PUMP."

COMPOUNDS ON RAIL AND SEA.

SIR,—The letter signed "Marine Engineer," which appeared in your issue dated the 9th inst., was an unusually interesting one on this subject.

Your correspondent endeavours to define the conditions which, in his opinion, differentiate marine compounding from locomotive compounding, and while not pronouncing a verdict wholly against the latter, he seemed to think that it should be confined to freight train working or, at any rate, that it would show up best on such service. If it be true that British engineers are more or less prejudiced against compound locomotives, it can only be so because the engines have been incorrectly designed.

"Marine Engineer" incidentally mentioned one important aspect of the question, which has not hitherto been discussed. I refer, as he did, to the fact that the boilers of both compound and simples are now virtually alike as regards size and steaming capacity. For equivalent boilers, the cylinders of the simple engine are invariably larger than those of the compound; hence, the deduction is perfectly reasonable that the compound is in reality

always under-cylindered. The single-expansion engine can, therefore, make use of a larger portion of the boiler power—the true measure of the power of any locomotive—than can the compound, and it is for this reason that the former is generally able to compete successfully against the latter. If, now, the compound be designed to suit the boiler capacity, the result will be very different. In other words, let the engine have two high-pressure cylinders of the same size as those of the simple for the same boiler, and it will then be obvious that a vast improvement will have been effected, since the addition of a low-pressure cylinder will enable the total piston area to be very considerably augmented. There are probably some engineers who will at once say that in such a case the compound will be over-cylindered, but it is clear that it will not be over-cylindered any more so than the corresponding simple, it being assumed that the adhesion is sufficient to prevent the driving wheels slipping at starting.

Your correspondent states that "it might be assumed that if two stages are desirable in expanding the steam in the marine engine, they would be equally desirable in a locomotive." My answer to that is that I have satisfied myself, in actual practice with locomotives, that double expansion is eminently and demonstrably desirable. I say this with all the force that practical experience justifies.

It may freely be admitted that the simple engine does perform its work remarkably well under widely varying conditions of power and speed. Therefore, it is only necessary to place the compound on an equality with it, as suggested, in order to make the latter a success. So far, this has not been done. How, for example, can a compound locomotive with one comparatively small high-pressure cylinder develop a tractive power at all proportionate to the boiler capacity of the engine? Moreover, such an engine will not be as flexible as one in which the high-pressure cylinders are as large as those of the simple, the engine being, in fact, in all respects similar to the simple, with the exception that it is compounded. If this course were followed, I am convinced that we should hear little or nothing about the lack of adaptability of the compound locomotive. It is quite true, as pointed out by "Marine Engineer," that the long steady haul that frequently obtains in freight and coal traffic is perhaps more especially favourable to the double-expansion type, in that the working conditions more closely coincide with those prevailing in marine transport. Nevertheless, the running of long-distance express passenger trains also involves conditions which are sufficiently uniform to render the use of properly designed compound locomotives distinctly advisable.

John Riekie.

London, S.E. 4, December 14th, 1927.

RECENT BRITISH LOCOMOTIVES.

Sir,—With reference to the letter of Mr. Riekie of the 8th inst. I would confirm that the comparative figures I gave were for saturated compounds and superheated simples as Mr. Riekie says. The conclusion which the Italian railways have come to is that as regards fuel economy the most efficient locomotives are the superheated compounds; next to them come the superheated simples, and after them the saturated compounds, which are, in their turn, more economical than the saturated simples. Compounding is certainly of value, and I did not wish to convey any idea against it.

As both compounding and superheating act against the same defects in the steam cycle, obviously in installing both one cannot obtain the sum of economies one could obtain by each separately. Italian experience proved superheating to be of greater advantage by itself than compounding by itself. Further, economy is not everything, and that is why only very heavy and powerful engines are superheated compounds in Italy, whilst the majority of the total number are either superheated simples or saturated compounds. Only very old, light or special service locomotives are saturated simples in Italy.

As to the exhaust of a simple engine taking place at 120 lb. that would mainly show that the engine is under-cylindered for its work.

I would add that a certain number of 262 saturated compounds were fitted with a superheater and worked considerably better than their saturated sister engines and also slightly better than their sister superheated simples, but to avoid the higher pressure considered advisable—228 lb. instead of 170 lb.—and the unsymmetrical pull on the frames the fitting of the superheaters were discarded after a year, and the compound engines are now transformed into superheated simples when convenient.

V. Pecori Giraldi.

Milan, December 20th, 1927.

BOILER EXPLOSION REPORTS.

Sir,—It would seem that a new *regime* has developed in the offices of the Board of Trade, and also in the Home Office, in connection with industrial accidents. While it is in the interests of the community at large that such accidents should be investigated officially, with the object of minimising them, is there not a lack of foresight in the measures which the Government takes in this direction?

To give a category of recent examples of this idea would cover more space than you can spare, as they include many cases, for instance, of fusible plugs failing, but two recent reports support my contention. Fortunately, in neither case was any life lost, but both are given extensive reports. While one could not have caused any serious disaster, the other was fraught with great danger. In the first case one of the water tubes used for heating a baker's oven burst through being overheated; in the other a steamship was in continual trouble through the repeated explosion of the tubes of its water-tube boilers, presumably on account of the use of sea water as make-up.

The two examples are dissimilar in that in the one case apparatus of the most elementary form was concerned, while in the other the machinery was complicated. The first was intended for the attention of men unskilled in mechanical affairs, while the second involved the holding of a B.O.T. certificate, and must, of necessity, have required a technical training. Nevertheless both these typical "explosions" are treated at equal length in the official reports; but they emphasise my contention that such affairs are not dealt with adequately by the authorities to which they have been entrusted. It is, for instance, not of great import to the world in general that a baker's oven should blow up—I cannot remember a fatality resulting in such a way—but should the boiler of a steamship explode the lives and the livelihood of many men must be put in jeopardy.

Would it not be more appropriate that the B.O.T. should concentrate its attention on those accidents which really involve technical considerations, and broadcast its findings, so that anyone interested might reap the benefit, while those accidents that indicate a lack of "horse sense" would receive a local reprimand? Is it not, also, time that the regulations as to the holding of a marine engineer's "ticket" were so adjusted as to conform to the widely differing conditions of service afloat?

January 8th, 1928. Boiler-man.

THE NEW TYNE BRIDGE.

Sir,—With reference to your article on the new Tyne Bridge in your copy of December 30th, it may be worth recording how this bridge came into being.

The proposal to build it was set going by myself in the local press in September, 1922, as a means of providing work for local unemployed, as a solution of the cross Tyne traffic, as the present High Level is the only real bridge on the Great North Road at that point, it being an old, narrow bridge, and because of the possibility of a large grant from the Ministry of Transport towards such a scheme.

I prepared a design of bridge in this identical position with a pier in the middle of the river. After pressing the advantages of the scheme before various local authorities, the idea was taken up by Newcastle and Gateshead Corporations in 1924.

The River Tyne Commissioners then insisted on a single span bridge, their idea being that the present Swing and High Level bridges form a barrier in the river, and hope for the ultimate removal of the Swing, and the rebuilding of Geo. Stephenson's famous work with greater spans.

I prepared a design of single span bowstring arch almost identical to the present structure in the effort to try to get a bridge of this magnitude put up for public competition in design. This idea, however, was not acceptable, as the matter was then in the hands of the present consulting engineers.

Thos. H. Webster, A.M. Inst. C.E., and Wh. Ex.

Newcastle-on-Tyne, January 8th, 1928.

B.E.S.A. Specifications.

TWO-PIN WALL PLUGS AND SOCKETS.

A specification just issued by the British Engineering Standards Association is a revision of B.S.S. No. 73, 1919, and is the result of three years' discussion by the B.E.S.A. in collaboration with representatives of supply companies, electrical contractors, Government Departments and the Wiring Regulations Committee of the Institution of Electrical Engineers. All British standard specifications are the result of co-operative effort on the part of the whole of the particular branch of industry concerned, but the point is emphasised in this particular case on account of the great interest shown by all the parties mentioned in the question of domestic electrical accessories. There is universal agreement to the general principle that articles, such as plugs and sockets, should be accurately interchangeable, as the inconvenience to the householder of having non-interchangeable plugs on his electrical appliances is obvious. The dimensions to secure interchangeability are the same in the new specification as in the old edition, so that plugs and sockets to the 1927 specification will be interchangeable with the existing standard fittings.

It has at various times been suggested that the standardisation of plugs and sockets should be confined to the dimensions to secure interchangeability, the general details of design and construction being left to the initiative of the manufacturer. This question has been very carefully considered by the B.E.S.A. Committee, and it has been decided that, owing to the unsatisfactory nature of so many of the non-standard plugs and sockets on the market, a certain assurance of quality was essential. The requirements of the old specification in this direction have therefore been retained, with certain modifications which experience with plugs to the old specification has shown to be desirable.

The most important feature of the specification is the introduction of a smaller size, rated at 2 ampères. The new series of standard sizes thus comprises 2, 5, 15 and 30 ampères. The ratings and sizes have been the subject of very lengthy discussion and tests, and after consideration of all the evidence for and against retaining the existing ratings, subject to the addition of the 2-ampère size it has been decided to retain the existing standards.

This specification deals only with plugs provided with a hand shield and side entry for the flexible conductor. The issue of further specifications for alternative types is still under discussion, but it will be recalled that the B.E.S.A. has recently issued a specification for protected type plugs and sockets with earthing connection—B.S.S. No. 196, 1927.

Copies of the new specification—No. 73, 1927—can be obtained from the publication department, British Engineering Standards Association, 28, Victoria-street, London, S.W. 1, price 2s. 2d. post free.

THE ELECTRICAL PERFORMANCE OF ROTARY CONVERTORS.

The final specification of a new series has just been issued by the British Engineering Standards Association. It replaces B.S.S. No. 72, 1917, for the performance of electrical machinery, and applies to rotary convertors for industrial purposes and tramway traction of 50 kW (direct working) or 50 kVA (inverted working) and upwards, having windings insulated with Class A material, as defined in an appendix, and to the apparatus associated therewith, including direct-driven exciters, direct-driven boosters, induction regulators and starting motors. It does not apply to rotary converters for railway service.

As is usual with the British standard electrical specifications, the first part of the document contains a list of definitions relating to the characteristics of the machines, but in this instance a new feature is introduced in the definition of standard wave form of direct-current voltage. Subsequent sections of the specification deal with rating, limits of temperature rise, overloads, commutation, parallel running, efficiency and power factor, high-voltage tests, overspeed, performance and type tests, and information to be given on rating plate. The specification proper is followed by a series of appendices, dealing with classification of insulating materials, service conditions, temperature measurements, information to be given with inquiry and order, and methods of declaring efficiency. As in all the B.S. specifications for electrical machinery, the recommendations of the International Electro-technical Commission have been adopted wherever possible.

Copies of the specification—No. 172, 1927—may be obtained from the publications department of the British Engineering Standards Association, 28, Victoria-street, London, S.W. 1, price 2s. 2d. post free.

PAINTING MATERIALS.

In continuance of their programme of work in the Paint and Varnish Section, the British Engineering Standards Association has just issued British Standard Specifications for Black Oil Pastes for Paints, Brunswick or Chrome Greens (Pure and Reduced) for Paints, Gold Size for Paints, Natural Siennas for Paints, Natural Umber for Paints, Ultramarine Blue for Paints and Red Lead (Non-setting) for Paints.

Limits for the chemical composition and the physical properties of the materials are specified, together with appendices giving standard methods for carrying out the tests necessary for the purchase of these materials. One of the main difficulties with which the Committees have had to contend has been the absence of data correlating the physical properties and chemical composition of the materials with their performance in actual use, and it is hoped that users of the specifications will keep records of their testing results and make them available for the Committee's use at a later stage when the specifications are revised. The publication of these specifications brings the number published up to approximately fifty, and as can be imagined, their preparation has involved the consideration of a large number of problems dealing with the correlation of chemical and physical tests and performance, most of which have been dealt with co-operatively by the members of the Committees in their own laboratories. It is difficult to estimate the value of the work which has been carried out in this manner by members without recompense, often at considerable personal inconvenience. Some of the problems, however, necessitate research of too fundamental a character to be dealt with in this manner, and them have been referred to the recently formed Research Association of the paint and varnish makers with which the closest co-operation is maintained.

In connection with the preparation of this series of specifications it is an indication of the attention that this work is receiving abroad and in our Colonies that the Australian Commonwealth Engineering Standards Association has formed a Paint and Varnish Section which is issuing specifications similar to those published by the parent body in this country. As is the case with the standards of the Australian organisation, these specifications closely follow the British, the only difference being where Australian climatic conditions necessitate alterations.

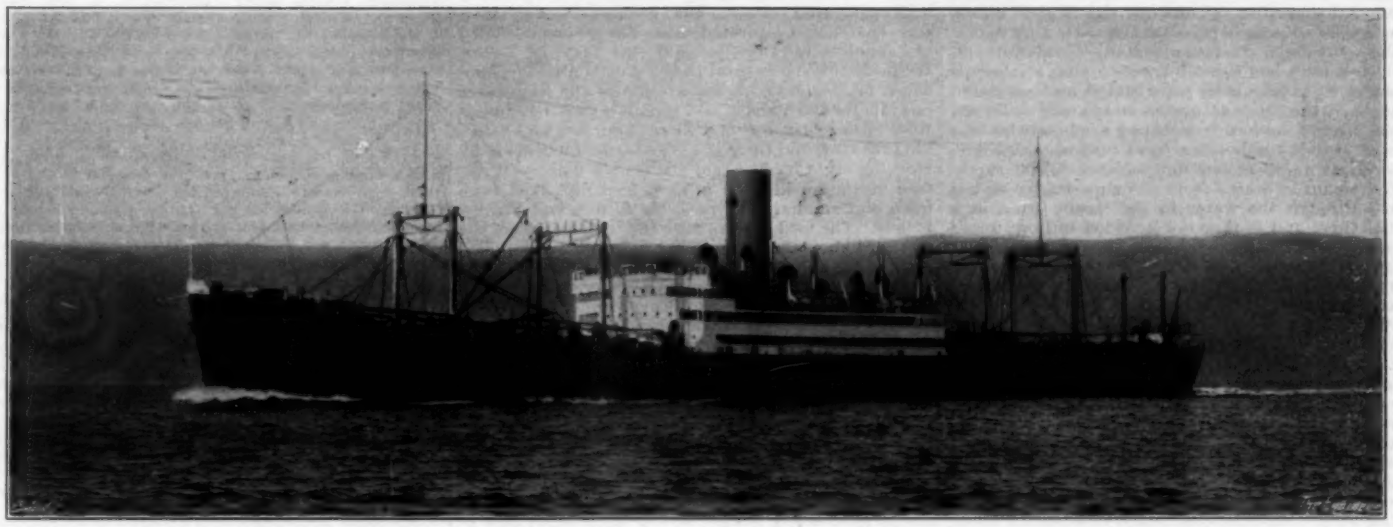
As has been pointed out in previous issues, the specifications will be revised as experience of their working or progress in the industry renders it necessary, and revised issues will be published from time to time.

Copies of these seven new specifications can be obtained from the B.E.S.A. Publications Department, 28, Victoria-street, London, S.W. 1, price 2s. 2d. each, post free.

When asked his opinion recently regarding the 1928 prospects of the Cornish tin-mining industry, Mr. M. T. Taylor, the superintendent of the East Pool Mine, said that the year 1927 had left a feeling of confidence and optimism. When all was said and done, it was the price of tin that governed the future of the world's tin-mining industry. He thought that we could look optimistically into the future if we closely examined the position of the various producing fields. Bolivia had reached the peak of her production, and the Malay States should reach that position within the next two or three years, but no great increase was anticipated. China, owing to internal trouble, would not affect the market for a considerable time. No new fields were looming in the distance, except, perhaps, Siam. Although there might be an increase of production for the next five or six years, he felt confident that, with the revival of trade both at home and abroad, the consumption would be such that no great advance in the world's visible supplies would take place, that they could look for a good remunerative price for tin, with a tendency to increase rather than decrease, and that the price would be such that at least 1 per cent. ore in Cornwall could be profitably mined.

THE CANADIAN PACIFIC CARGO STEAMER BEAVERBURN

WILLIAM DENNY AND BROTHERS, LTD., DUMBARTON, BUILDERS AND ENGINEERS



The Canadian Pacific Cargo Steamer Beaverburn.

IN our last issue, when describing the progress made in the shipbuilding and marine engineering industries during 1927, we made reference to the five large cargo vessels which were ordered last year by the Canadian Pacific Railway Company for its service between London and Montreal, and will be managed by Canadian Pacific Steamships, Ltd., London. The first of these ships to be completed was the Beaverburn. She was built by William Denny and Brothers, Ltd., Dumbarton, was launched in September, and was finished towards the close of the year. After undergoing successful trials on the Clyde, she left the Tail of the Bank on Saturday evening, December 24th, and arrived safely at St. John, New Brunswick, on Monday, January 2nd, after a successful voyage in heavy weather. Two other ships, the Beaverford and Beaverhill, have been launched by Barclay, Curle and Co., Ltd., Glasgow, and are about to undergo trials; while the sister vessels, the Beaverbrae and Beaverdale, are being fitted out at the Walker yard of Sir W. G. Armstrong, Whitworth and Co., Ltd. By the courtesy of the owners and builders, we are now able to give a full description of the Beaverburn and her propelling machinery.

HULL PARTICULARS.

The vessel, an illustration of which is given above, has a length on the water line of 512ft., with a breadth, moulded, of 61ft. 6in., and a depth, moulded, of 40ft. 6in. She is designed for a deadweight carrying capacity of nearly 13,000 tons on a mean draught of 30ft., and her gross tonnage is round about 10,000 tons, with a service speed of about 14 knots. She has been specially built to the requirements of Lloyd's 100 A 1 class, and to the British Board of Trade and Canadian regulations under the supervision of A. T. Wall and Co., naval architects, of Liverpool, and of Mr. J. Johnson, the chief superintendent engineer of Canadian Pacific Steamships, Ltd.

As will be seen from the engraving, the stem of the vessel is raked forward, and it is of the rounded plate type. In general, the hull and the fore end of the ship have been specially strengthened as a protection against damage by floating ice in the St. Lawrence River. The vessel has six cargo holds, three forward and three aft of the engine and boiler-room spaces and coal bunkers. Holds Nos. 4 and 5 are insulated, and all cargo spaces are fitted with complete systems of electric fans and trunking to enable fruit cargoes to be carried. In addition, ample natural ventilation has been provided in all the hold and 'tween deck spaces. The refrigerating equipment was supplied by J. and E. Hall, Ltd., of Dartford, and the insulation by Newell's Insulation Company, Ltd. No. 4 lower 'tween deck spaces are cooled by brine pipes and are fitted with meat rails for carrying chilled meat; while the No. 4 hold and also the No. 5 'tween deck spaces are also cooled by brine, and will be used for carrying frozen meat. In the case of No. 5 lower hold, there are two chambers, each with independent air coolers and trunking systems, while the ship's cold chambers comprise a series of separate compartments for meat, fish and dairy produce, which are cooled by brine pipes. The upper 'tween deck spaces throughout the ship are so designed as to be readily adapted for carrying cattle, and for that reason large gangway doors are fitted on each side of the ship to facilitate embarking and disembarking.

An unusual feature in the design of the hull is a duct keel which has been fitted from the forward end of the boiler-room and is led through the double bottom into the forward hold. Within this hollow keel there are grouped the bilge and ballast pipes which serve the forward hold and the ballast tanks. The cargo-handling gear, which is of the most complete and up-to-date type, comprises no less than twenty-seven tubular steel derricks, one of which is designed to handle loads up to 45 tons. As will be seen from our illustration, ordinary pole masts have not been fitted, but instead of them a system of twin derrick posts with cross bridges, two of which carry masts has been employed. There are seventeen winches serving the various holds, all of which are steam driven, and were supplied by John Lynn and Co., Ltd., of Sunderland. The windlass, which is also steam-driven, was built by Clarke, Chapman and Co., Ltd., of Gateshead, while the steering gear is of the Brown type, and is controlled by standard telemotor gear from the navigating bridge and also from the deck aft. Life-saving appliances, which are considerably in excess of those required by the British Board of Trade and Canadian Government regulations, are carried.

Accommodation for officers and crew is provided amidships in deck-houses on the boat, bridge and upper decks, the captain's accommodation being self-contained and arranged at the forward end of the boat deck. The officers and engineers have their quarters on the bridge deck, and the seamen, firemen and greasers have accommodation on the upper deck. The accommodation throughout is of a particularly high standard. All the officers and engineers are berthed in separate cabins, and all the seamen and firemen have small rooms, there being no large open compartments. The mess-room and lavatory accommodation is well arranged also, and a separate mess-room for each class of the crew has been provided.

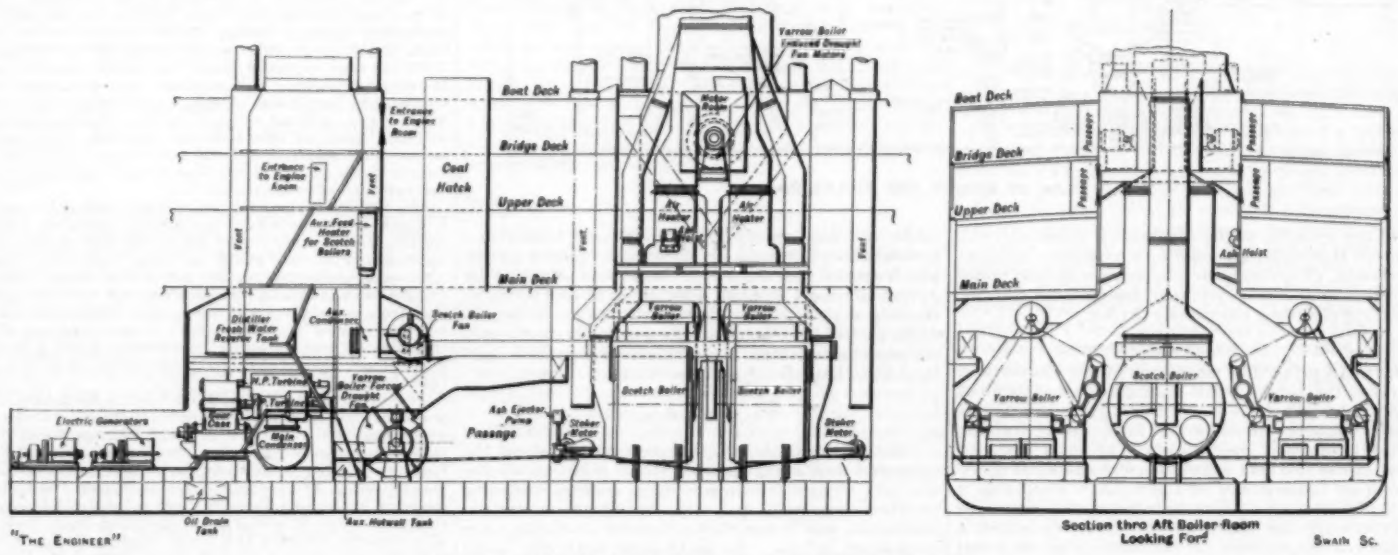


FIG. 1—ENGINE ROOM AND BOILER ROOM ARRANGEMENT

BOILER EQUIPMENT.

The main interest in the cargo steamer Beaverburn and her two sister ships Beaverford and Beaverdale is the combination of Yarrow and Scotch boilers. In the sister ships, the Beaverhill and Beaverbrae, hand-fired Babcock and Wilcox boilers, with superheaters, will be installed. The general arrangement of the boilers in the Beaverburn is clearly shown in Fig. 1, and also to the right hand of Fig. 2. It will be seen that the two Yarrow boilers are placed in the two wings of the boiler-rooms with the Scotch boilers at the centre. The Yarrow boilers installed in the Beaverburn were built by Denny Brothers, Ltd., and the superheaters were supplied by Yarrow and Co., Ltd., which firm will supply the boiler installation for the two sister ships. All the boilers are designed to work at a pressure of 250 lb. per square inch. The water-tube boilers, as well as the Scotch boilers, are fitted with superheaters, the degree of superheat

being about 250 deg. Fah., giving a total steam temperature of 650 deg. As the Yarrow boilers are intended to supply superheated steam to the turbines only, the arrangement of the auxiliaries is such that every precaution is taken to exclude oil and other impurities from these boilers, the make-up feed being obtained by passing steam from the Scotch boilers into the intermediate pressure turbines, and thence to the condenser. The two Scotch boilers are hand-fired, and each has three furnaces. One of them is arranged to supply both superheated and saturated steam, and the other saturated steam only. To one of the Yarrow boilers is attached a de-superheating device, so that the boiler can, in case of emergency, provide saturated steam for port use. The superheated steam is drawn from the superheater and is passed through the water in the steam drum in a special tube, and is thus re-converted into saturated steam. It will be recalled that on the turbine steamer King George a similar arrangement was made for operating the auxiliary machinery. The boilers are all arranged for coal burning, and the Yarrow boilers are fitted with Erith-Roe stokers of the latest type, which were supplied by Erith's Engineering Company, Ltd. In our last issue a view of one of the boilers for a sister ship, fitted with the stoker, was given, as was also a view inside the combustion chamber.

Referring to Fig. 1, it will be seen that the air pre-heaters for the Yarrow boilers are arranged in the uptakes. They are designed to give an air temperature of about 320 deg. Fah. The forced draught arrangement for the water-tube boilers comprises a fan, driven by a steam turbine, which delivers air along ducts through the air heaters, and thence to the space below the mechanical stoker grates. During the recent trials of the Beaverburn the air pressure in the ashpit was, we understand, about ½in. water column. It may be further noted that an electrically driven induced draught fan is placed above the air heaters is clearly shown in Fig. 2. A feature of its design is the arrangement of interchangeable engines for driving the forced draught fans, the circulating pumps and the dynamos, so that there are seven auxiliary engines with interchangeable working parts in the ship. All these engines are arranged for operating with superated steam, but connections for both superheated and saturated steam are provided. They are supplied by Drysdale and Co., Ltd., of Yoker. We have already referred to the special arrangements which are made for the separation of the feed-water services for the Yarrow and Scotch boilers. Separate Weir surface heaters and filters and hot well tanks are provided, and there is a gravitation filter made by Hocking and Co., Ltd., for the Scotch boilers. Pressure filters are inserted in each feed pipe line, both main and auxiliary, for both the Scotch and Yarrow boilers. The feed heaters raise the temperature of the water to about 220 deg. Fah., and they are supplied with exhaust steam from the auxiliary engines, which is first passed through a grease extractor of the North-Eastern Marine Engineering Company's make. The drains from the feed heaters are led to a drain cooler and thence to the auxiliary hot-well tanks. For feeding the Yarrow boilers there are two sets of Weir's feed pumps, and there are also two sets of similar independent feed pumps for the Scotch boilers. The feed control on the Yarrow boilers is assured by feed-water regulators, supplied by A. G. Mumford, Ltd., of Colchester. Along the forward bulkhead there are arranged the feed pumps and the pumps for lubricating oil. The latter comprise four forced lubrication pumps of the Weir type, two of which are used in service, while two serve as stand-by sets. These pumps work in connection with two oil coolers of Serck design, and the oil is fed through the oil coolers, under pressure, to all the turbine bearings and the sprayers on the gear-box, and is then drained to large tanks beneath the gear casing. Little remains

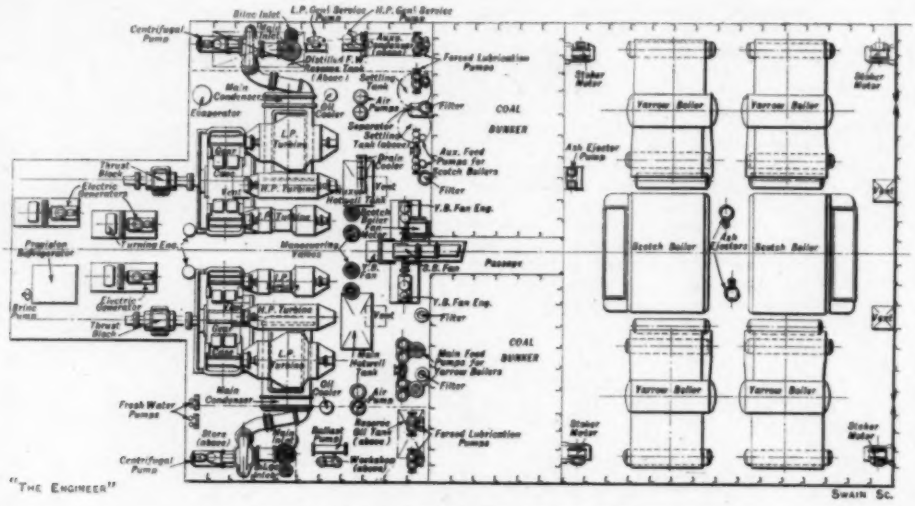


FIG. 2—PLAN OF ENGINE AND BOILER ROOMS

to aid the draught of the furnaces, if necessary, and to ensure that under all conditions a balanced draught is obtained. The two Scotch boilers are worked under the ordinary Howden system of draught, the fans for the air supply being electrically driven.

MAIN PROPELLING MACHINERY.

The main propelling machinery of the Beaverburn comprises two sets of single-reduction geared turbines of the Parsons type, each consisting of a high-pressure, intermediate-pressure and low-pressure turbine, driving a common gear wheel. The total designed power of the two sets is 7350 normal and 8000 maximum shaft horse-power at 110 r.p.m. From Fig. 2 it will be seen that each turbine drives the main gear wheel through an independent pinion to which a flexible coupling is fitted. The pinions are disposed round the upper half of the main gear wheel, the high-pressure pinion being uppermost. The intermediate pressure turbine is arranged on the inside of each set and the low-pressure turbine on the outside, so that a free run is given for the circulating water pipes. Special provision was made to ensure that the materials of which the turbine was built would be particularly suitable for operation with superheated steam. The casing of the high-pressure turbine is made in cast steel and part of its blading, which is of the all-reaction type, is made of Monel metal. End-tightened blading is fitted to this turbine, and it is balanced by means of dummies. The intermediate-pressure turbine is also of the all-reaction type, but has blades of normal design, and with it is incorporated a high-pressure astern turbine of the impulse type. The low-pressure turbine is again an all-reaction cylinder, and along with it is incorporated a low-pressure astern turbine. As our drawing shows, the main condensers are bolted directly to the low-pressure turbine flanges.

ENGINE-ROOM AUXILIARIES.

The general arrangement of the auxiliary machinery to be said with regard to the bilge and ballast and general service pumps, or of the ash injector pump, which are of the usual type, and were supplied by J. Lamont and Co., Ltd. Electric light and power in the ship is provided by three steam-driven generator units, each of 50 kW output. As previously mentioned, the engines were built by Drysdale and Co., Ltd., and they drive Laurence-Scott generators.

TRIAL RESULTS.

Prior to the trials, which were carried out on the measured mile at Skelmorlie, steam trials on all the auxiliary engines were made in the makers' works, to ascertain the exact fuel consumption under various conditions, and it was shown that the sets were very economical in use. In accordance with the usual practice of Canadian Pacific Steamships, Ltd., the vessel made her maiden voyage at reduced power of about 5000 S.H.P., only three of the four Yarrow boilers being in use. The voyage to St. John, New Brunswick, was made in very heavy weather, but a speed of 13 knots was maintained, and all the machinery, including the mechanical stokers, performed its work in an excellent manner. The coal used during the trials was of a low-grade quality, in small pieces, and the calorific value was only 10,700 B.Th.U. per lb. The owners do not wish to give exact figures for the trials and the maiden voyage, as more will be made known concerning the performance of these ships when they have settled down to normal service. We are informed, however, that the results so far show that there is every possibility of getting down to a figure of 1·1 lb. of coal per S.H.P. hour, which, it is expected, will be obtained when the vessels are in actual service and are burning ordinary bunker coal.

The Beaverburn is certainly a noteworthy vessel in every way, representative of the most recent marine steam practice, and she reflects great credit on her owners, designers and builders.

The Quarterly Shipbuilding Returns.

THE statistics issued by Lloyd's Register of Shipping regarding vessels under construction at the end of December show the improvement which has taken place in the shipbuilding industry all over the world. In this country especially, after a severe depression lasting well over two and a-half years, the tonnage now being built nearly reaches 1,600,000 tons, and is larger than the combined tonnage being built in the rest of the world. The present figures for Great Britain and Ireland—1,579,713 tons—are not only more than double those reached twelve months ago, but they include practically no tonnage on which work is suspended, while at the end of December, 1926, such vessels accounted for 100,000 tons out of the total then recorded. It may be of interest to state that just over 200,000 tons of the tonnage now being built in this country will be registered in the British Dominions and close on 200,000 tons are intended for foreign shipowners.

Abroad there are 1,539,008 tons under construction, Germany leading with 472,295 tons, which is considerably more than double the tonnage being built in that country at the end of December, 1926, which points to the expansion which has recently taken place in the activities of German yards. Only four other countries abroad have more than 100,000 tons under construction, viz.:—Italy, 183,216 tons; Holland, 174,887 tons; France, 115,029 tons; and Sweden, 100,700 tons. It may be stated that the present world total of 3,118,721 tons, although so much higher than the average for the last five years, is still 185,000 tons lower than the average reached during the last twelve months before the war.

Of special importance to all parties interested in the immediate future of the shipbuilding industry are the figures referring to vessels commenced and vessels launched. In Great Britain and Ireland the tonnage commenced during the fourth quarter of the year—377,492 tons—is nothing like sufficient to replace on the stocks the tonnage launched during the same period—498,550 tons—that figure being the largest reached during any quarter since December, 1920. The launches abroad during the quarter—337,073 tons—show a large increase as compared with the previous quarter, but the tonnage commenced—258,696 tons—is smaller, so that, in the case of Great Britain and Ireland, the tonnage commenced is not sufficient to replace the tonnage launched during the quarter.

There was a remarkable increase in the tanker tonnage under construction during the last twelve months. At December, 1926, the tanker tonnage being built was 371,000 tons; at the end of March, 1927, it had increased to 603,000 tons; at the end of September the total reached 775,600 tons, and is now 744,700 tons, of which 339,500 tons are being built in Great Britain and Ireland. It will be noticed that tankers represent nearly 24 per cent. of the total tonnage under construction in the world.

The total figures show that shipowners tend more and more to yield in their allegiance to the well-tried steam engine in favour of the internal combustion engine, although to a much larger extent abroad than in this country. Of the total under construction in Great Britain and Ireland, motor ships account for 652,894 tons—over 41 per cent. of the total being built—while abroad the motorship tonnage reaches 956,994 tons—over 62 per cent. of the total. The world figures for motorships—1,609,888 tons—actually exceed by 115,356 tons the total for steam tonnage. This constant increase is also well indicated by the number of large vessels under construction which are to be fitted with oil engines. Taking only into account vessels of 6000 tons and upwards, there are 60 steamers as compared with 127 motorships; and of the 56 vessels which exceed 10,000 tons each, 17 are steamers as compared with 39 motorships.

The striking progress of the internal combustion engine is again demonstrated by the figures respecting marine engines which, at the end of December, were either under construction at the works or being fitted on board. Although, unfortunately, the totals for steam turbine engines being built in Germany are not available, and, therefore, complete world figures for marine engines of all types cannot be given, Lloyd's Register Returns show that the oil engines under construction total 1,234,000 horse-power against 557,000 horse-power for steam reciprocating engines.

The pre-eminent position which Lloyd's Register retains amongst the classification societies of the world is strikingly demonstrated by the fact that the tonnage being built throughout the world under the inspection of Lloyd's Register—2,168,248 tons—is the largest recorded since March, 1922. The tonnage in Great Britain and Ireland intended for Lloyd's Register Class is 1,426,434 tons, and represents over 90 per cent. of the total being built in this country. Taking the world figures, nearly 70 per cent. of the total tonnage is under survey by Lloyd's Register.

THE Yukon River is navigable for large steamers from its mouth to Whitehorse, Yukon Territory, Canada, a distance of about 2000 miles. The only obstruction to navigation which steamers cannot overcome with their own power at all stages of water is at the Five-fingers Rapids, so-called from five rocks which stand up out of the water like the finger tips of some giant hand. No difficulty is experienced at these rapids during the greater part of the season, but at the period of extreme high water the fall, at one point, is just sufficient to lift the big stern wheel of an upward-bound steamer for a few seconds out of the water. That brief space of time is sufficient for a ship to lose headway and be carried down stream. To overcome this, when steam navigation was first undertaken on the river, an improvement was made by which a steel cable was attached to suitable ring bolts in rocks above and below the rapids and the cable itself allowed to lie slack in the water. When steamers bound upstream reach the foot of the rapids the cable is taken on board and looped around a steam-driven capstan. As fast as the steamer pulls herself up river the slack or lower end of the cable is paid out overside into the water again. Once the critical point in the rapids is passed the cable is cast off into the river bed, where it is immediately available for the next steamer bound upstream.

Water Supply in 1927.

No. II.*

Cardiff.

Llwynon Reservoir.—The Llwynon reservoir has a capacity of 1260 million gallons. It is situated on the river Taff in Breconshire, and with two other reservoirs impounds the waters from a drainage area of 10,400 acres consisting chiefly of open mountain land. Its construction was completed during the year, but for some years to come it will only be utilised to supply compensation water to the river, and the mains necessary to convey the water for supply to Cardiff are not to be laid at the present time.

Taff Fawr Pipe Line.—The laying of the Taff Fawr pipe line was completed in December, or about two months over the contract date for completion. A serious delay of about six months, caused last year by the coal difficulty, was nearly made good by the contractors, Messrs. Guest, Keen and Piggotts, who manufactured about 5 miles of 30in. steel concrete-lined pipes, and Messrs. Lehane, Mackenzie and Shand, who laid them in the main Cardiff–Merthyr Road from Pontypridd to Taff's Well in about thirty-two weeks. The whole of the conduit from the reservoirs in Breconshire to Cardiff, consisting of 14 miles of 27in., 11½ miles of 30in., and 3 miles of 24in. steel concrete-lined pipes with subsidiary works is now in use.

Wenallt Reservoir.—The construction of the Wenallt storage reservoir was complicated by the faulty nature of the ground on the site, which necessitated the excavation of a large quantity of soft material and its replacement with concrete. Bore-holes were also sunk and cement injected where necessary into the substrata of conglomerate rock. The reservoir is elliptical in plan, the axes being 588ft. and 263ft. respectively. The depth of water is 20ft. and the capacity 15 million gallons. It is divided by a wall along the line of the minor axis and the southern half was completed during the year. The work was carried out by direct labour, the François Cementation Company, and the Western Trinidad Lake Asphalt Company.

Glasgow.

At the end of 1926 the structural works at the outlet dam at the Trossachs end of Loch Katrine, and also at the inlet basins to the two aqueducts, were completed and the water was raised to the level of 14ft. 6in. The severe storm at the end of January, 1927, however, caused considerable damage to the pitching and to the new road on the north side of the loch, which necessitated the immediate lowering of the level of the water in the loch to the previous level of 12ft. in order that the damage might be repaired. The work of repair steadily progressed throughout the year, and, with the exception of a few minor operations, it is now practically completed, so that the water level of the loch may be raised as required.

Throughout the year lengthy sections of the Old Mugdock tunnel were shut off for examination, and the internal repairs which were found necessary were carried out.

Liverpool.

Aber Tunnel.—During the year 1927, the inlet heading of the Aber Tunnel was advanced 992ft., and no special difficulties were encountered. In order to accelerate the rate of progress preparations are now being made to commence driving from the outlet end so as to meet the heading which is being driven from the other side.

Vyrnwy Aqueduct.—The work of laying the first portion of the third instalment of the aqueduct from Lake Vyrnwy was completed by the contractors, Sir William Prescott and Sons, Ltd., of London. It consists of a length of 4½ miles, divided into two sections, one on each side of the balancing reservoir at Parc Uchaf, about midway between the Lake and Oswestry. These sections have been cross-connected to the two existing mains at each end of the new lengths, with the result that an additional quantity of 3½ million gallons per day is now being delivered at Oswestry. The next length of the aqueduct to be taken in hand will be that lying between Oswestry and Cotebrook, and preparations are being made for commencing a section of this work next spring.

Londonderry.

In connection with the Banagher water scheme, the driving of the tunnel through Corrody Hill was completed in July. Owing to the infiltration, through fissures, of water containing iron salts, the tunnel is being lined throughout with concrete, and the lining is about half finished. The construction of the 20 miles long aqueduct is being carried out by direct labour. The pipes being used are Stanton-Hume spun reinforced concrete tubes in the cut-and-cover portions and cast iron and steel pipes, bitumen lined, for the syphons. The first pipe was laid in July, and some 2½ miles had been laid by the end of the year. Difficult ground had to be negotiated, including a bog and two river crossings. There was also a considerable amount of rock cutting. A start was made on a short tunnel through Caugh Hill. The excavation of the trial trenches for the dam in the Altnaheglish Valley were proceeded with and a site giving promise of a rock foundation at the bottom and sides was discovered at a depth of some 20ft. below the surface. The dam, which will be of concrete, will be of the arch type and 100ft. high above the river bed.

Manchester.

Heaton Park Reservoir.—The construction of the service reservoir at Heaton Park, which was begun in 1907 and suspended during the period of the war, was resumed in 1923, and was completed during last year with the exception of a parapet wall round the embankment. The reservoir is being gradually filled with water to test its water-tightness, but it is not likely to be brought into use for some time. It has a surface area of 77½ acres, an average depth of 26ft., and a capacity of 570,000,000 gallons. It is intended as an additional terminal reservoir for water drawn from Thirlmere.

Haweswater Scheme.—Most of the land forming the watershed included in the Haweswater scheme has been acquired, and negotiations are proceeding for the acquisition of land and easements required in connection with the aqueduct from Haweswater to Manchester. It is provided in the Act authorising the construction of the works at Haweswater that the West Ward of the Westmorland County Council should be given a supply of water from a tank at a sufficient altitude to distribute the water by gravitation over the West and East Wards, and works to afford that supply, including the laying of about five miles of 6in. steel pipes are now in progress, and are expected to be finished next summer.

Distribution.—In connection with the distribution of water in the city and surrounding districts, a trunk main, consisting of 40in. and 24in. pipes, three miles in length, was laid during the year, and an installation of electrically-driven pumps has been provided in the westerly area of supply in order to maintain the requisite pressure in the high level districts.

Mid-Sussex Joint Water Board.

The Mid-Sussex Joint Water Board completed and put into service in August a new reservoir at Balcombe. This reservoir, which is of reinforced concrete, has a storage capacity of 517,000 gallons, and its completion brings up the total storage possessed by the Board to 812,000 gallons. Its construction necessitated the removal of some 3000 cubic yards of soil. The structure measures 89ft. square and it is 12ft. deep from the floor to the roof, which is supported between the walls on twenty-five columns arranged in five rows of five each. The walls, which are 6in. thick at the base and 4in. thick at the top, are stiffened in the usual manner by vertical counterforts placed at intervals. The roof is of concrete 3½in. thick and its beams transmit the load to the columns and walls. There are two inlets, one for receiving water from the Holywell works of the Board, the other being connected to an adjacent older reservoir. There are also two outlets, from one of which the supply main is led, while the other can be used for emptying the water in the reservoir into a dump well in case of need.

Nottingham.

The Colwick Hill covered service reservoir, which has a capacity of 3½ million gallons, and particulars of which were given in our Annual Article last year, was completed during the year and put into full service. The duplication of the mechanical filtration plant at Eastwood, which consists of forty-two 8ft. diameter steel filter shells—Bell's design—sedimentation tanks, lagoons and the usual ancillary works, was also completed and the additional filters are ready for dealing with the second instalment of water to be received from the Derwent Valley Water Board. The buildings for the bore-hole pumping plant at Burton Joyce are in hand and it is hoped that the new electrical pumps will be set to work in about a year's time.

Plymouth.

Good progress was made during the year with the Burrator reservoir enlargement works. At the Sheepstor embankment the wing trenches were filled in with concrete and the embankment was raised to the full height. To complete that part of the work only a small amount of pitching on the inner slope and the construction of a road over the top remain to be carried out. At the Burrator masonry dam all demolition work was finished and the overflow was rebuilt to within some 3ft. or 4ft. of its full height. The hearting of the dam on each side of the overflow was also completed and very shortly a commencement will be made with the re-erection of the arches to carry the roadway over the overflow. All the new roads were completed and the suspension bridge which was erected to carry traffic across the reservoir while the dam is being raised is still doing excellent service.

Portsmouth.

During the year Portsmouth equipped and put into service a new pumping station at Havant. This station contains three pumping engines, each designed to deliver between 5 and 6 million gallons of water per day against an average head of 180ft., and it is believed to be larger than any other single water-works pumping station in the British Isles, with the exception of some of those of the Metropolitan Water Board. The Portsmouth supply is noteworthy in that it is obtained wholly from springs which have never been known to fail. Even during the drought of 1921 there was always a surplus over and above the needs of the consumers, though the average volume abstracted was 10 million gallons per day. The new pumping sets comprise triple-expansion vertical engines, each of the cylinders of which actuates a plunger pump with a ram 20½in. diameter by 36in. stroke. During the official tests the three sets showed a mechanical efficiency of practically 90 per cent.

Wakefield.

It will be remembered that Wakefield's Ryburn scheme, for which powers were obtained in 1924, includes the construction of two reservoirs in the Urban Districts of Rishworth and Soyland, to be formed by dams respectively 134ft. and 100ft. high above the level of the stream; a pipe line some 21 miles in length, consisting of 22in. and 20in. cast iron and steel pipes; intake works; river, railway and canal crossings; a tunnel in the Urban District of Barkisland some half-mile in length; and mechanical filtration plant at Kirkhamgate, near Wakefield, designed to filter 2·6 million gallons of water per day.

The intake works, consisting of a concrete dam 30ft. in height, were completed during the year, and about three miles of 22in. cast iron pipes with steel pipes at special crossings, were laid by direct labour. The half-mile tunnel at Barkisland was driven, and about three-quarters of the length lined with concrete, the size internally being 6ft. 6in. by 4ft.

The pipe line from the Barkisland Tunnel outlet to Ardsley Reservoir, about 18 miles in length, is being laid. It consists of 22in. and 20in. cast iron and steel pipes, and a total length of rather more than 9 miles has been laid.

Reinforced Concrete Bridges, &c.—A contract for the construction of four reinforced concrete bridges, together with a one million gallons balancing tank at the outlet end of Barkisland Tunnel, and gauge basins, &c., at Ardsley Reservoir, was let, and already two of the bridges have been built and the piles for the third driven.

The filter house at Kirkhamgate was built, and the erection of the filtration plant finished. In connection with the Ryburn Reservoir the access from the Rochdale-road to the site of the works was constructed, temporary buildings erected, and electric power from the Yorkshire Electric Power Company installed. Excavation for the foundations has just been begun.

Worthing.

In September Worthing formally put into service some new works designed to augment the supply obtainable from its Broadwater works. The new works comprise, in the first instance, a pumping station at Patching which is built over two bore-holes, each 30in. in diameter and each having a total depth of 500ft., the first 100ft. of which are lined with steel tubes. In each bore-hole there is a five-stage electrically driven centrifugal pump designed to deliver 1,000,000 gallons of water per twenty-four hours against a total head of 300ft. The current for operating the motors is obtained from the Corporation's generating station at Worthing. The water derived from these wells is, for the most part, conveyed to a recently constructed reservoir at Durrington, through a 14in. diameter cast iron pipe line, but a small proportion of it is raised by electrically-driven booster pumps to a small reservoir of 56,000 gallons capacity, which has been built above the pumping station and which is employed for supplying the high-level districts of the hamlets of Patching and Clapham. The Durrington Reservoir has a capacity of 500,000 gallons. It is designed to act, in conjunction with a smaller reservoir adjacent to it, for the supply of water to Durrington, West Tarring—and, later, to Goring-by-Sea—and adjoining districts, and to furnish water to two boosting pumps installed in a pump house near by, which are each designed to lift 15,000 gallons per hour to what is known as the High Salvington Reservoir, which has a capacity of 500,000 gallons and stands at an elevation of 430ft. above Ordnance Datum, and supplies the high-level district.

New Chicago Waterworks Tunnel.

Chicago, which takes its water supply from Lake Michigan by a series of tunnels extending 2 to 3 miles under the lake to intake shafts surmounted by cribs, is engaged in driving a new tunnel which will extend about 3 miles from shore, in solid rock, and at a depth of about 190ft. below the water surface, and 60ft. to 80ft. below the top of rock formation. The tunnel has vertical sides, a semi-circular roof and a slightly concave floor. For about half its length it is 16ft. wide and 16ft. high, the remainder is 13ft. by 13ft. With a flow velocity of 1ft. per second, the capacity is 138 million gallons daily for the larger and 90 million gallons daily for the smaller section. From the land end of this tunnel about 8 miles of tunnel will

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supplement the present tunnels under the city to the several pumping stations.

France.

A problem which received attention during the year was the supply of water in sufficient quantity to meet the needs of the growing population of Paris and the suburbs. Outside Paris, water is drawn from the Seine and the Marne, and no more can be obtained from those rivers without running the risk of interfering with the navigation on them during the summer months. As all available supplies are now utilised, the Paris Municipal Council has had to extend the filtering beds at Ivry, and the sterilising works at St. Maur are being enlarged for the treatment of Marne water by the ozone process. A similar plant is also being laid down at Orly. Such installations cannot, however, solve the problem which now confronts the Paris and suburban councils, and future requirements can obviously only be met by some big scheme for bringing supplies from beyond the limit of the sources now utilised.

During the year negotiations were actively carried out for the construction of a first series of three barrage reservoirs on the upper reaches of the Seine. The proposal to construct the three artificial lakes has been approved by the various commissions, and there is hope that it will be finally sanctioned and that the works be started in the course of the present year. They alone, however, cannot satisfy future requirements, and the Paris Municipal Council is convinced that the water scarcity threatened during the next ten years or so can only be averted by the construction of an aqueduct from the Vals de Loire, the subterranean water from which is capable, it is estimated, of supplying Paris with a million cubic metres a day.

Amongst other schemes carried out during the year was the completion of new aqueducts for bringing additional water to Bordeaux, and, as the result of the long drought in the south of France last summer, the Government voted credits to provide communes in the Hérault and elsewhere with constant supplies.

Singapore Supply from Johore.

During the past twelve months the pipe line between the Gunong Pulai Reservoir in the State of Johore and the existing Seletar Reservoir in the Island of Singapore, representing a total length of about 30 miles, part of it traversing the causeway between the Island and the mainland, was completed. On April 24th H.H. the Sultan of Johore performed the ceremony of opening this portion of the work, by which a temporary supply of about 4 million gallons a day is obtained from the Gunong Pulai and is caused to discharge into the existing Seletar Reservoir.

The whole of the excavation in connection with the Gunong Pulai Dam was completed and the construction of the dam itself is now in progress. All the roadwork leading up to the dam was finished, including a concrete viaduct of five spans having a total length of about 230ft., which carries the roadway as a branch over the Gunong Pulai to the site of the filter house.

About 920ft. of the tunnel through which the water from an adjacent stream is to be diverted into the Gunong Pulai were driven. The total length of the tunnel will be 1146ft.

A contract was let to the Paterson Engineering Company, Ltd., for the supply of a battery of filters, and work in connection with that matter will shortly be put in hand. Tenders were also invited for the construction of the Fort Canning Reservoir to contain 30 million gallons, but ultimately it was decided by the municipality to carry out this work departmentally, and it is now in progress. The whole of the excavation was completed and a portion of the concrete floor was put in place. The reservoir will be covered with a series of concrete domes supported on columns, and its construction necessitates the production of a large number of pre-cast concrete blocks, many of which have now been made.

The road leading to the site of the Pontian Kechil work, which will form the second instalment of the undertaking, has now been made, and it is anticipated that work will seriously begin within the next few weeks on the construction of the earth embankment, pumping station, &c., which will be carried out by direct administration under the consulting engineers, Messrs. Sir Alex. Binnie Son and Deacon.

Other Works Abroad.

Calcutta has very important extension works in hand, and Delhi is laying out 20 lakhs of rupees on waterworks extensions. The Rand Water Board is expending £186,000 on increasing its pumping and other equipment to make available a further instalment of water from the Vaal River. Good progress was made with the foundations for the main dam for the Hume reservoir on the Murray River, Australia. The contractors handed over the Khami dam to the Bulawayo Municipality. The ordinary capacity of the reservoir formed by it is 830 million gallons, but it can be increased by collapsible shutters to 1246 million gallons. Its completion will make the adoption of a water-carriage system possible. Montreal is about to spend three-quarters of a million dollars on new sand filters. The Cordeaux dam, for the augmentation of the water supply of Sydney, to which we have several times referred, was officially handed over to the Water Board and put into service early in February. With the desire still further to increase its water supply, Sydney is also considering two schemes which have been brought forward. One is to obtain water from the Snowy River at a cost of no less than £42,000,000, while the other, which is less pretentious, as its estimated cost is only £12,000,000, is to be it from the Warragamba. In both cases it is proposed to incorporate an electric generating station in the scheme. Arrangements were being made early in the year for the driving of a second tunnel to carry the water from the Catskills to New York. This tunnel is to be some 20 miles long, and will be cut in the rock at a depth of some 500ft. It is stated that it is to have a carrying capacity of as much as 700 million gallons per day. The present tunnel, which it will duplicate, is capable of passing 500 million gallons per day. The second instalment of the Steenbras scheme for increasing the supply of water to Cape Town was continued during the year. The work, which comprises the raising of the Steenbras dam by 40ft.—which will mean increasing its length from 900ft. to 1300ft.—will have the effect of forming a reservoir containing 6,424,000,000 gallons, and will ensure a daily supply of 15,000,000 gallons to the city. It is interesting to note that as, for the time being, more water will be available than is actually required for present needs, the surplus is to be used for the generation of electrical energy. The city, by the way, is to spend some £400,000 on its water undertakings. The Melbourne and Metropolitan Board of Works is about to construct—if, indeed, the operations have not already been begun—the largest reservoir of its water supply system. The reservoir, which is to be at Sylvan, will be formed by an earthern embankment about 2100ft. in length and 136ft. 6in. in height, which, incidentally, will be, it is said, the highest embankment of its type in Australia. It is to have a concrete core wall of cellular construction. The Mexican Government had under consideration the construction of a huge irrigation reservoir in the Rio Santiago Canyon, not far from Aguascalientes. The suggested reservoir is to contain as much as 70,000,000,000 gallons. An interesting and picturesque reinforced concrete core water tower has been built at Wanganui, in New Zealand. It has a capacity of 120,000 gallons, and stands some 165ft. high. The most important scheme being carried out by South Australia is the Tod River supply, which is to furnish water over an area of no less than 9850 square miles in Eyre's Peninsular. It entails the formation of a weir on the Tod River, and another across the Pillaworta creek, the construction of a concrete-lined channel, 4664ft. long, to conduct the water to an impounding reservoir with a capacity of 2400 million gallons, and the laying of 240 miles of trunk mains and about 500 miles of reticulation mains.

New Water Sterilising Process.

Although the Bunau-Varilla process of sterilising water was introduced some years ago in France, it was only during last year that information concerning it was published in this country. It consists, essentially, in adding a chlorine solution in infinitesimally small doses to the water to be sterilised, and the introducer claims that, when using these exceedingly small doses—amounting to only 3¼ oz. or so per million gallons—the treated water takes on a radio-active quality which has the effect of immediately destroying all bacteria. It was stated that the system had been applied with success at Rheims, Carcassone, Monte Carlo, Sables d'Olonne, Aix-les-Bains and Compiègne. Experts in this country are not satisfied of the efficiency of the process, and during last year nothing further was heard of the system, while, on the other hand, the ozone process of sterilisation made considerable strides in France.

An Interesting Centenary.

On June 22nd the Corporation of Greenock celebrated the centenary of Shaws Water Joint Stock Company's Works, which were originally constructed for supplying water to the burgh and for operating a number of water wheels. The company was formed by Sir Michael Shaw Stewart, Bart., who was Superior of Greenock and of the greater portion of lands in the neighbourhood. Acting on the advice of Mr. Thom, of Rothesay, a water engineer of considerable repute, he decided to form a reservoir in the course of Shaws Water by the construction of an embankment and to bring the water to the town by an aqueduct. An Act of Parliament sanctioning the works was obtained in 1825. What was at first known as the Great Reservoir, but is now called Loch Thom, after its constructor, was formed. It contained 1780 million gallons. There was also a compensation reservoir containing 90 million gallons and a main aqueduct known as the "Cut," which is 5½ miles in length. This aqueduct was at an elevation of some 500ft. above the town, and that difference in elevation was taken advantage of to sell the water to millowners and others for operating power plants. The sluices admitting water to the "Cut" were opened by the then Chief Magistrate of the town—Mr. William Leitch—on April 16th, 1827, and to celebrate the event Mr. Leitch and a party of others went the full length of the aqueduct in a boat. The undertaking was a success from the start and its scope had several times to be enlarged. After one or two unsuccessful attempts the undertaking was finally purchased by the town from the company for £170,000 in 1866, and it still forms part of the town's waterworks.

CARBONISATION CONFERENCE.

A CARBONISATION Conference will be held under the auspices of the Joint Fuel Committee of the Society of Chemical Industry, the Institution of Gas Engineers, the Coke Oven Managers' Association, and the Institute of Fuel, from Tuesday, February 21st, to Friday, February 24th. The meetings will be held in the Midland Institute Lecture Theatre, Paradise-street, Birmingham, on Tuesday, Wednesday, and Thursday, and in the Queen's College, Paradise-street, on Friday. There will be morning and afternoon sessions on each day.

Wednesday afternoon will be spent at the British Industries Fair, those attending the Conference being invited by the Management Committee of the Fair to take luncheon there. On Thursday morning there will be a visit to the Birmingham Gasworks. A large number of papers of outstanding interest relating to carbonisation will be discussed, and the papers delivered before the constituent societies during the past two years will be covered in the discussions.

The processes of low-temperature carbonisation will be fully discussed on Friday. No papers will be fully read, contributors giving a *précis* only. Full details will be published in the immediate future.

Application should be made for tickets and programmes to the Hon. Secretary, Joint Fuel Committee, Allington House, Victoria-street, London, S.W. 1.

CALENDARS, DIARIES, &c.

CAMBRIAN WAGON COMPANY, Ltd., Cardiff, Wales.—Wall calendar with daily tear-off slips.

COUNTY OF LONDON ELECTRIC SUPPLY COMPANY, Ltd., County House, New Broad-street, E.C. 2.—Greeting card and telephone number list.

CROSSLEY BROS., Ltd., Manchester.—Wall calendar with daily tear-off slips.

DORMAN, LONG AND CO., Ltd., 4, Central-buildings, Westminster, S.W. 1.—Wall calendar with monthly tear-off slips.

G. AND T. EARLE [1925], Ltd., Wilmington, Hull.—Wall calendar, 1928–9–30, with monthly tear-off sheets.

ENGLISH ELECTRIC COMPANY, Ltd., Queen's House, Kingsway, W.C. 2.—Desk calendar with daily tear-off slips.

FLOWERDEW AND CO., 227–228, Strand, W.C. 2.—Calendar with monthly tear-off slips.

B. J. HALL AND CO., Ltd., Shell Corner, Kingsway, W.C. 2.—Wall calendar with monthly tear-off sheets.

ALFRED HERBERT, Ltd., Coventry.—"Atritor" wall calendar with monthly tear-off sheets. "Engineer's" calendar with monthly tear-off sheets.

HILDICK AND HILDICK, Walsall.—Wall calendar with daily tear-off slips.

BERNARD HOLLAND AND CO., 17, Victoria-street, S.W. 1.—Wall calendar with monthly tear-off sheets.

HULSE AND CO., Ltd., Ordsal Works, Manchester.—Wall calendar with monthly tear-off sheets.

WM. JESSOP AND SONS, Ltd., Brightside Works, Sheffield.—Wall calendar with daily tear-off sheets.

LANCASHIRE UNITED TRANSPORT AND POWER COMPANY, Ltd., Atherton, Lancs.—Calendar with monthly tear-off slips.

OIL WELL SUPPLY COMPANY, Dashwood House, E.C.—Pocket diary.

PENNSYLVANIA RAILROAD COMPANY (Wm. Bryde, Special Agent, 20, Water-street, Liverpool).—Wall calendar with three-monthly tear-off sheets.

PRIEST FURNACES, Ltd., 123, Albert-road, Middlesbrough.—Refill for desk calendar.

H. RIDDELL, Ltd., 40, St. Enoch-square, Glasgow, C. 1.—Wall calendar with monthly tear-off sheets.

JOHN ROGERSON AND CO., Ltd., Wolsingham S.O., Co. Durham.—Wall calendar with monthly tear-off sheets.

SIEMENS-SCHUCKERT (GREAT BRITAIN), Ltd., 109, Kingsway, W.C. 2.—Wall calendar with monthly and daily tear-off sheets.

S. S. STOTT AND CO., Laneside Foundry, Haslingden.—Wall calendar with monthly tear-off sheets.

THAMES TUBE AND FITTINGS COMPANY (GREAT BRITAIN), Ltd., Crown Works, Lots-road, Chelsea, S.W. 10.—Pocket diary.

J. I. THORNYCROFT AND CO., Ltd., Thornycroft House, Smith-square, Westminster, S.W. 1.—Note wallet and wall calendar with monthly tear-off slips.

C. TOWNSEND HOOK AND CO., Ltd., 102–4, Queen Victoria-street, E.C. 4.—Wall calendar with monthly tear-off slips.

J. TULLIS AND SON, Ltd., St. Amis Works, Glasgow.—Desk calendar and diary.

URQUHART, LINDSAY AND ROBERTSON ORCHAR, Ltd., Dundee.—Wall calendar with monthly tear-off slips.

WELIN-MACLACHLAN DAVITS, Ltd., Hopetoun House, Lloyd's avenue, E.C. 3.—Refill for desk calendar.

ROYAL SOCIETY OF ARTS COMPETITION OF INDUSTRIAL DESIGNS.—Particulars of the fifth annual competition of industrial designs to be held at the Imperial Institute, South Kensington, London, S.W., in June, 1928, have now been issued, and can be obtained from the Secretary of the Royal Society of Arts, John-street, Adelphi, London, W.C. 2. Intending competitors must apply to the Secretary of the Society between May 1st and May 12th for the necessary entry forms. The competition will be divided under the following heads:—(1) Architectural decoration, (2) textiles, (3) furniture, (4) book production, (5) pottery and glass, (6) miscellaneous. In all, scholarships and prizes amounting to nearly £1600 are offered in connection with the 1928 competition.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

January Quarterly Meeting.

THERE was a very large and representative gathering of producers of iron and steel from all parts of the Kingdom, at the January quarterly meeting of the Midland iron trade in Birmingham to-day, Thursday. Everyone was anxious to gather and piece together the evidences as to the future trend of industrial development and the prospects of business in the iron and steel market. Though the outlook was generally agreed to be less dark than at the last quarterly meeting, many usually enthusiastic *habitues* of the Exchange were taciturn. They recollect previous quarterly meetings, when indications of good trade have been discerned but have failed, as a result of one thing or another, to materialise, and they prefer not to commit themselves. Other equally well-known industrialists expressed considerable optimism. On the whole, it may safely be said that a more hopeful spirit exists at date than prevailed a month ago, but it remains for the future to vindicate it. Though inquiries for material in considerable bulk were in circulation to-day, those with business to place were in no hurry to come to agreement. They thoroughly sounded the market in the hope of obtaining price concessions, and then in many cases withheld the order. Some forward contracts were, however, entered into, and when it is possible, at the end of the week, to tabulate information as to the actual business done, it is quite possible the aggregate tonnage will be very considerable. There are evidences that a large amount of iron and steel will be required during the first six months of the year. As I pointed out in my letter last week, many Midland works are becoming reasonably busy, and industrially vision is clearing. Manufacturers have in many cases brought forward from the old year sufficient orders to occupy them while the new demand is taking shape. Some of them made only a cautious beginning, but there are others who have work enough on hand to keep all their resources busy for a month or two ahead, while a few very fortunate firms are well placed to midsummer. Iron and steel masters are not expecting too much, so they are not likely to be disappointed; it seems much more probable they will receive an agreeable surprise.

Pig Iron Situation.

The situation in the Midland pig iron industry has changed little, if any, since I last wrote, and smelters at to-day's quarterly meeting were far from cheered by the immediate prospects. There was some revival of inquiry indicating increased interest, and instances were reported of firms which were prepared to buy for six months ahead. Producers and consumers, however, were at variance as to prices. Sellers asked an advance on business placed beyond three months, and this consumers were not prepared to concede. They even pressed for better terms for tonnages required for current consumption. The recent sagging tendency of prices, especially in respect of Northamptonshire brands, combined with the knowledge that furnaces—as the result of the continuance of production during the Christmas holiday period while consumption was suspended—have large stocks of material in hand, has unsettled the market. During the past week a few sellers anxious to reduce their holdings have disposed of quantities at "cut" rates, but on 'Change to-day they did not seem disposed to offer more at the same figure. At the time of writing the conflict as to values is still being waged, and it is impossible to foresee the ultimate result. A few weeks ago the impression was fairly general that prices in this department had reached bottom, and any fall now would help to postpone the much desired revival of buying. Stable prices are absolutely necessary if industry is to progress further, and a conviction that raw iron prices are at the minimum would undoubtedly help towards, if not result in, a marked reinvigoration of buying and of trade.

Staffordshire Bar Iron.

Staffordshire ironmasters are experiencing quite a good run of business, especially those dealing in best class iron. The quarterly meeting swelled the volume of inquiries, orders and specifications, much of which business it is considered has been influenced by the recent reduction in prices, which brought marked bars to the lowest point they have reached for more than twelve years. Ironmasters find it impossible under present conditions to preserve the price relationship which formerly existed between marked bars and Crown bars. Any regulation of the unmarked bar section seems to have disappeared, and there is no specific standard by which the products of different mills can be tested. Some Staffordshire mills maintain that it is impossible to produce Crown bars to sell at less than £10 10s. a ton, but other mills offer Crown bars at 20s. or 25s. less. Difference of quality is stated to be the only thing which can account for such a disparity. Lancashire makers' products quoted at £9 10s. are held by Staffordshire makers to be very inferior, but they appear to be selling in fairly large quantities in the Birmingham area. Staffordshire nut and bolt and hurdle iron at £9 per ton finds few buyers, despite the fact that the Black Country bolt and nut works are well employed. Belgian No. 3 iron, now procurable at £5 17s. 6d. to £6 per ton delivered, is being chiefly used in these works, producers maintaining that they must use the cheaper material if they are successfully to compete for orders. A lot of wrought iron gas tube strip is being supplied to the tube works at £11 10s. per ton. Tube makers in Birmingham to-day complained of increasing competition from Germany and of the difficulty in getting orders. Ironmasters hereabouts are cheered by the recent trend of events. A good deal of new work is known to be pending in connection with shipbuilding and railway requirements, and good tonnages of iron should be required. Engineers and engine builders are also likely to be better customers.

Steel Position.

At to-day's quarterly meeting there was no rush to obtain supplies of steel. The mills are in a position to supply material of any description at any near date, and as no material change in prices is anticipated, consumers do not consider that there is anything to be gained by buying in larger quantities than fit in with the work in their yards or works. They are quite content to buy for the present and let the future take care of itself. Steel masters, however, displayed no anxiety as to the future trend of business on this account. They know that steel will be required in large quantities before the quarter is out, and there is just a chance they may realise better prices anon. Their chief worry is, in some departments, the keen internal competition which develops immediately a good order comes into the market, and more especially the severe competition of German and continental makers. The rebate scheme inaugurated to deal with this matter has now been in operation for four months. Those buyers who have taken the pledge to place their orders at home are now entitled to the first instalment of the rebate, and the question will arise whether the experiment is worth pursuing on its present basis. There are those who consider the prospects of the heavy steel industry re-establishing its position as a result of the scheme, very small. Many steel masters are, however, said to be fairly satisfied with the response of consumers to the scheme. Producers of steel have been helped to some extent in recent weeks by the rise of from 2s. 6d. to 5s. per ton in prices of foreign steel as the result of the threatened German labour crisis. In the Midlands the opinion is growing that the threat will not be executed. Birmingham importing merchants expect to receive further supplies of foreign steel without interruption. Nevertheless there has been a rise in the price of imported materials of practically every kind. In semi-finished materials the quotation is a minimum of £5 7s. 6d. running up to £5 10s. This is a very important change, because native billets can be got for £6 5s., and English users, as a rule, want a much more substantial advantage. Finished steel bars are quoted at £5 18s. 6d. from the Continent, but sales have been made as high as £6 1s. Midland steel mills are making very fair time, although they could do with a good deal more work. Conversations on 'Change to-day lead to the conviction that the prospects for steel orders are very good from the shipbuilding, railway and constructional aspects. A few railway orders are already coming out, but no big railway extensions are indicated, the new business being chiefly in the way of reconstruction and renewal. It will, however, be considerable, and should find a lot of work for the mills during the year. Shipbuilders are improving customers for plates, and a large amount of plant renovation up and down the country calls for a lot of boiler-plates. Steel business negotiated this week was on the basis of the following quotations:—Angles and joists, £7 12s. 6d.; tees, £8 12s. 6d.; ship, bridge and tank plates, ¾in. and over, £8 7s. 6d.; boiler plates, £11 to £11 10s.; small bars, £7 7s. 6d.; soft billets, £6, delivered in the district. Staffordshire hoops were named £10 10s. at works.

Galvanised Sheets.

Galvanised sheets are still rather listless, 24-gauge corrugateds selling at a minimum of £13, though the nominal figure is £13 2s. 6d. Buyers can demand almost any delivery. Export business is still withheld, home demand is small and mills have little work in view. Manufacturers believe, nevertheless, that there is a latent demand, and this was in some measure confirmed by inquiries and offers which were in circulation at to-day's quarterly meeting. Makers firmly refused to entertain offers at prices below £13. They generally hold the view that business will improve from now onward, and that prices will advance. Makers to-day asserted that they were confident that steady progress may now be looked for. They do not want anything in the nature of a boom, if such were possible with the present capacity of the mills, but desire a steady trade with sufficient improvement in prices to cover the costs of production. There is a fairly large consumption of plates and sheets for making up purposes.

Scrap.

The recovery of the tin-plate trade is well maintained, and has brought about healthier conditions in the Birmingham scrap market. Demand has been stimulated, and the price has risen from £2 18s. 6d. to £3 per ton delivered South Wales. Merchants who have large stocks are hoping considerably to reduce them in the near future.

Fuel.

Midland industrialists are fortunate at the opening of the year in having the advantage of moderately cheap fuel. Works coal can be purchased at 16s. per ton. Furnace coke at 12s. to 12s. 6d., and foundry coke at 25s., are considered very favourable prices, and as good as any that can be expected by consumers.

Birmingham Metal Trade Merger.

An important union in the non-ferrous metal industry, greatly affecting Birmingham, is foreshadowed by the announcement that an agreement has been entered into by Imperial Chemical Industries, Ltd., for the acquisition of the ordinary shares of Elliott's Metal Company, Ltd., of Selly Oak, Birmingham. If the provisional agreement receives the assent of the necessary majority of Elliott's shareholders it will mean a very important extension of the already substantial interests of Imperial Chemical Industries in the Birmingham district. The combine is already interested in the non-ferrous metal industry through its control of Nobels, which includes Kynochs, while Elliotts control Muntz's Metal Company, William Cooper and Goode, Ltd., and Hughes Stubbs Metal Company. On the chemical side, too, Imperial Chemical Industries controls Chance and Hunt, Ltd., of Oldbury. Elliott's Metal Company, which was registered in 1874, has an authorised capital of £1,500,000, while Imperial Chemical Industries, which was registered just over a year ago, has an authorised capital of £65,000,000.

Metallurgical Instruction.

The associated manufacturers in the non-ferrous metal trades have approved a scheme for the further education of boys and youths engaged in rolling mills in Birmingham. Although not compulsory, it is provided that all boys and youths under twenty should attend classes at the evening institutes, and in certain cases at the technical colleges. It is also proposed to arrange a special course in metallurgy at the Central Technical College; students' fees will be refunded by the employers' committee to all those who attain a certain standard of attendance and proficiency, while, in addition, the employers offer prizes for attendance and home work. The employers intend, I learn, to give better promotion in the trade to youths who, while proving themselves competent in the works, are also taking advantage of the educational facilities set forth in the scheme.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Marketing Lancashire Coal.

IN considering a co-operative scheme for the marketing of coal, Lancashire colliery owners are falling into line with other areas. So far, however, the matter has not proceeded beyond the preliminary stages of discussion. At a private meeting here on Thursday of last week of Lancashire and Cheshire owners, members of the coalowners' association held a joint conference with owners who are not members of the association, and a lengthy discussion took place on the scheme which has been inaugurated in Yorkshire and the Midland counties. About fifty owners attended the meeting, but it is understood that no definite decision was reached, and that a similar scheme covering the Lancashire and Cheshire fields could not be adopted unless all the owners co-operated.

Inquiry into Gas-holder Explosion.

The official inquiry by the Ministry of Health into the cause of the gas-holder explosion which occurred last August at the Bradford-road gasworks of the Manchester Corporation has been provisionally fixed for this month, for a date to be arranged definitely later this week. Two gas-holders were destroyed in the explosion, and it is now regarded as likely that two others will not be used again. There will thus be only two holders remaining at the works in question, one of which has a capacity of 10,000,000 cubic feet, and is among the largest in the country.

Wide Difference Between Tenders.

Arising out of the important extensions that are being made at the Millgate electricity works of the Stockport Corporation, the Electricity Committee, on the ground that it did not feel justified in coming to a decision because of the wide differences between the British and foreign tenders for a 20,000-kW turbine, has remitted the matter to a special sub-committee for consideration and report to the Town Council. The tenders of British manufacturers ranged from £51,325 to £60,815, whilst the tender submitted by one continental firm was as low as £39,502.

Personal.

At a meeting last week of the Mersey Docks and Harbour Board, it was announced that Mr. T. M. Newell, engineer-in-chief to the Board, would shortly retire from that position, which is understood to be worth £3500 a year.

Obituary.

Mr. E. L. Morgan, borough engineer at Bolton, has died at the age of sixty-two. Mr. Morgan was appointed deputy borough engineer at Bolton in 1900, after being engaged on railway constructional work in Spain and occupying positions in South Wales and at St. Helens, Lancashire.

Non-ferrous Metals.

One of the most striking features of the past week's operations in the non-ferrous metals market has been the sharp decline in tin, bringing values for cast metal at the moment of writing much below the lowest prices reached during the recent spell of cheap tin. Visible supplies of the metal, as revealed by the December month-end statistics, were no higher than the market had anticipated, and the cause of the decline is believed to be the very poor demand just now from domestic consumers of tin, coupled with reports that are current to the effect that stocks of the metal held by consuming interests on the Continent are above the normal. What the immediate future will bring in the way of price movements on this section of the market is extremely problematical, and it is difficult to find anyone here who is prepared to hazard an opinion. In the case of copper, a steady tone has ruled virtually throughout the week, with prices on balance fractionally higher than they were at last report. It is the continued reserve of holders of the metal rather than any particularly satisfactory feature about the demand for it that is giving strength to the market. Buying interest in the case of lead is about back to where it was before the slight spurt set in in the closing weeks of last year, and values have suffered a comparatively important decline in consequence, as offers of the metal are being freely made. Spelter has remained fairly steady, for, although the demand is only on moderate lines, the statistical position of late has been more in favour of sellers.

Iron.

Although sellers of pig iron on this market are still hopeful of an early improvement in the forward buying position, there has been some disappointment that signs of this have not already made themselves felt. In some quarters the hesitancy of users is attributed partly to a deirse to defer buying until after the Birmingham meeting this week, and partly to the fact that many of the foundries have hardly yet got into full swing after the holidays. In so far as buyers cannot reasonably look for

appreciably lower prices for pig iron, there is not, of course, the same formidable obstacle to contract commitments here as there is in the case of steel. In the meantime, although there has been a slight inquiry about during the past week and a few orders have been placed, the rate of consumption just now is below the level of production at the blast-furnaces. In spite of this, however, quotations have been steadily maintained in most instances, Staffordshire makes being quoted at about 72s. 6d., Derbyshire at 73s. 3d., Middlesbrough at 78s. 2d., Scottish at 87s. 6d. to 88s., and hematite iron of West Coast origin at 85s., including delivery in each case to works in this area. With regard to finished iron the position at the moment is much the same as it has been at any time almost during the last six months, the demand being poor and much below the capacity of makers in the district. Lancashire Crown bars, however, are quite steady at £10 per ton, with second-quality material currently quoted at £9 10s.

Steel.

Although some constructional engineering firms in Lancashire report a lull in new inquiries, others express themselves as satisfied with the position in this respect. In all cases, however, the state of the order books is such as to ensure a fair degree of activity for several months. Unfortunately, from the point of view of the steel trade, buyers in this important branch of the consuming industries are adhering rigidly to their policy of buying merely for early needs, a policy which, in common with other consumers, they are able to pursue with comparative comfort because of the keen competition among sellers for orders and of the fact that in nearly every case virtually prompt delivery of most classes of steel materials is obtainable. Prices of home-manufactured steel are steady so far as joists and tank plates are concerned, these being quoted at £7 12s. 6d. and £8 7s. 6d. per ton. In the case of boiler plates, however, the tendency is still easy at £10 2s. 6d. to £10 5s. for basic and about £10 10s. per ton for acid plates, with bars at £7 10s. for small re-rolled sorts and £8 5s. to £8 10s. for the larger sizes. Continental steel on this market has been quiet, particularly for the semi-finished materials, and prices are easy at about £4 17s. 6d. per ton for billets, from £5 to £5 2s. 6d. for sheet bars, £7 10s. for Siemens plates, £7 2s. 6d. for Thomas plates, £5 12s. 6d. for joists and sections, £5 17s. 6d. for angles, £6 7s. 6d. for wire rods, and £5 17s. 6d. for steel bars, delivered to Lancashire users' works, for cash against shipping documents.

BARROW-IN-FURNESS.

General Conditions.

There is nothing to report in the way of an improvement in the hematite pig iron trade in this district. Those works which closed down, having heavy stocks, are gradually reducing the iron which they have in store, but the reduction is not rapid. Orders are being received, but not for heavy tonnage, and there is little or no inclination to place orders for forward delivery. Trade seems to be confined to orders for immediate requirements. Fortunately, the steel departments still require iron, otherwise there would be an immediate reduction in the number of furnaces in blast. Foreign trade is very dull, and although America is not out of the market, there is not much activity at present. The ore trade is mostly confined to requirements in the district, as very little is going outside. The mines are only moderately employed, and as regards foreign ore imports are naturally restricted. The steel works at Barrow continue to be employed in the rail, merchant, Siemens and hoop departments, but unless fresh orders are secured within the next few weeks the prospects are not very bright. There may be enough orders for the rail mills for the next five or six weeks. The hoop works are fully booked up and the outlook is good. Work has been begun on the extensions to the Barrow power station, where additional plant will be installed which will increase the output to the extent of 3500 kW. This extra power is badly needed in the district. As much of the plant as possible is being produced at Vickers' works, Barrow, the order being placed with that firm with a view to providing employment locally.

SHEFFIELD.

(From our own Correspondent.)

Poor Demand for Steel.

The production of open-hearth steel has been partly resumed, and the indications are that quiet conditions will prevail for some time. A fair period, in fact, will probably elapse before the works get back to the state of activity prevailing before the stoppage for the Christmas holidays, though even that was poor. Six of the fourteen furnaces at Templeborough belonging to the United Steel Companies were started last week, but the adjoining plant at the Ickles had a further week's holiday. Other of the large works resumed on pretty much the same level as at the end of December. The mills are not rolling a great amount of material, and generally there is a good deal of idleness throughout the city. This is shown in concrete form by the official unemployment returns, the latest weekly figures showing an increase of 6202. The total unemployed in the city is nearly 27,000, with nearly 9000 short-time workers. The additions recorded recently are largely accounted for by suspensions among the heavy steel workers. Employment is more regular in the medium and lighter trades, where the prospects may be described as fairly good. Orders for special quality steels are coming through consistently.

Steel Trade Developments.

In its latest review of trade conditions, the Sheffield Chamber of Commerce draws attention to several important developments. Success, states the report, has been achieved in the production of a new steel to meet the special requirements of steam turbine builders. As usual, the engineers set the steel makers a difficult task, and as usual the steel makers have proved equal to it. The engineers wanted a steel blade that would stand extremely high temperatures, great stresses, and erosion. Experiments were set going, and the outcome is the production of a steel by a well-known firm, which, it is claimed, meets the requirements. Sheffield industry has made itself still more necessary to the general, the mining, the railway, the electrical, the automobile and the aircraft engineer. Heavy armaments continue slack, but may be better in the coming year. Ordinary ship steel is only in moderate request locally, though the shipyards associated with the big Sheffield firms are better off for orders than the majority of shipbuilding establishments. Structural steel is moderate, and will be in much better demand when the new electricity scheme is well launched, and begins to call for the standards, &c., it will require. Local rolling mills may be adapted for this work. There is a fairly good volume of employment on railway material, with the promise of more business from India, Africa and New Zealand. Steel pit props, together with steel beams for the mines, will be coming into greater demand before long. Mining inspectors are recommending steel in place of wood, colliery owners are making special investigations, preliminary reports are favourable, and with timber becoming scarcer and dearer, while steel is relatively cheaper than for many years, the future for steel props and beams seems well assured. A promising line or group of lines, and one to which our local firms are paying due attention, is that covering miscellaneous steel fittings for houses and other buildings, railway carriages, and ships. Both house and ship builders are taking more and more frames, rails, racks and other items in steel instead of wood. Even furniture makers are turning to steel. The hollow steel tube is steadily ousting the wooden rail from some of its long-held situations.

Huge Gas Engine.

A satisfactory trial run has been given to the last of the set of three 7000 H.P. gas engines which the Staveley Coal and Iron Company has installed at its Devonshire Works at Staveley. All three engines are driven by blast-furnace gases and exhaust steam. They are to be used for generating electricity, and the Staveley Company has now an output of approximately 60,000,000 kilowatts annually. The completion of this set of gas engines marks a definite step in the progressive scheme of electricity distribution launched by the late Mr. Charles Markham. The development of the scheme has been assisted by co-operation with local authorities, firms and collieries, and lines have been constructed to link up with the Derbyshire and Nottinghamshire Electric Power Company, so as to co-ordinate the system of supply throughout an extensive area. The Staveley Company at present provides a bulk supply of current to Chesterfield Corporation, to public lighting services in eight towns and villages around Chesterfield, and to a number of collieries and works in addition to its own. Apparatus for using oil fuel in an emergency has been fitted to the main boilers at Devonshire Works.

Threat to Close Works.

AT the Old Jetty, Morecombe, Thos. W. Ward, Ltd., has a ship-breaking works, where many famous vessels have been dismantled, and which have been a source of interest to many visitors. A proposal, however, has been put forward by Morecombe Corporation to purchase and close down these works, which are perhaps the most important of the few industrial concerns in the town. If this scheme is carried through, it will mean throwing out of employment from seventy to one hundred men who have been in regular work. The workmen are not only urging the Corporation to refrain from pressing a scheme which will take away their livelihood, but they are making a canvass of their townspeople in order to support their protest.

Steel Firm's Losses.

The debenture holders of Jonas and Colver, Novo Steel Works, Sheffield, have appointed as receiver Mr. H. E. Jenkinson, chartered accountant, of Sheffield, under whose control the business of the firm is being carried on. The following letter has been sent out by Jonas and Colver: "As a result of the losses sustained by the company during the coal strike, and consequential losses, the company has to obtain additional financial assistance. While this matter is being arranged, the debenture holders have appointed a receiver to protect the assets of the concern." The firm was established in 1870, and has an authorised capital of £1,000,000.

Low-temperature Carbonisation.

I referred last week to the arrangement that has been come to with the board of Low-temperature Carbonisation, Ltd., and the owners of Askern Colliery, near Doncaster, for the erection of plant to work the Parker low-temperature carbonisation process. Since then there has been a conference at Askern between the officials and the Low-temperature Carbonisation Company's engineering experts as to the lay-out and erection of the plant. Discussing the Askern project with representatives of the Press, Colonel W. A. Bristowe managing director of Low-temperature Carbonisation, Ltd., stated that the works would be able to deal with about 3000 tons of coal a week. He estimated that in the course of a year the Doncaster collieries sent away anything up to 200,000 tons of slack coal and sold it at prices very much below what it cost to raise. Under the new method, so long as slack was being brought to the surface, the work of distillation could continue and would provide steady and regular employment all the year.

Colliery Amalgamation.

Two very old West Yorkshire concerns—Terry Greaves and Co., Ltd., of Old Roundwood Collieries, near Wakefield, and the Denby Grange Collieries, Ltd.—have amalgamated. A holding company has been formed under the name of Terry Greaves and Lister Kaye, Ltd. Both concerns will continue to trade under their respective names and management. The amalgamation has taken place under the new Act of 1927, instead of under the Mining Industry Act, 1926, as no compulsory powers will be required. The output of the amalgamated concerns will be about 500,000 tons of coal a year.

Orders from Germany.

Speaking at a Gainsborough meeting recently, Major H. D. Marshall, head of the firm of Marshall, Sons and Co., Ltd., mentioned that although times were not so prosperous, during the last year forty-five threshing machines had been sold by his firm to Germany, which showed that at any rate the countries of Europe still appreciated the work turned out in England.

NORTH OF ENGLAND.

(From our own Correspondent.)

Brighter Iron Trade Outlook.

THE outlook generally in the Cleveland pig iron trade is regarded as quite bright. Inquiries now circulating are numerous, and in some cases large. Confidence in steady trade development is rather pronounced, and there is a growing inclination to negotiate for delivery over periods ahead. Both the home and overseas demands are expected to expand, and as the conciliatory feeling between employers and employees promises absence of labour disputes, gradual increase in production is looked for. Reports of satisfactory trade in America and the likelihood of less keen continental competition in certain markets assist to strengthen the position in this district. With the opinion prevailing that quotations will fluctuate little, consumers are inclined to operate more freely than for some time past. Output of Cleveland pig iron is barely equal to needs, and stocks are low, so that makers are in a very strong position. The bulk of the make continues to be absorbed at local foundries, but demand from other quarters is improving, though on continental account it keeps very light. Prices are unchanged, No. 1 Cleveland foundry iron being 67s. 6d.; No. 3 G.M.B., 65s.; No. 4 foundry, 64s.; and No. 4 forge, 63s. 6d.

Hematite Pig Iron.

There is little change of moment to note in the condition of things in the East Coast hematite pig iron trade, and the market continues on the quiet side. Consumers are still showing little inclination to place orders for metal except for small tonnages to cover their immediate needs. The outlook at the moment does not present any striking feature, though it offers no particular occasion for pessimism. All that is looked for is a quiet steady trade at prices around existing levels. Orders are held that will maintain the existing output for some time to come. Producers, however, are anticipating an improvement in both home and continental demand, and are less inclined to cut prices. Customers, as a rule, stipulate for iron to special analysis, but market rates are still based on quotations for mixed numbers, which range from 70s. to 70s. 6d. per ton.

Ironmaking Materials.

The foreign ore trade continues dull and featureless. Consumers are well bought over the first half of the year, and are disinclined to negotiate for supplies further ahead, though merchants hint at possible shortage towards the autumn, as continental users have bought heavily up to the end of the year, and in some cases beyond that period. Nominally, the market price of best Rubio ore remains at 21s. per ton c.i.f. Tees. Continued offers of Durham blast-furnace coke makers to sell at unprofitable prices fail to tempt consumers to purchase extensively. Good average qualities are round about 17s. 6d. per ton delivered at the works.

Manufactured Iron and Steel.

Although foreign competition in the manufactured iron and steel trade is still intense, producers in this district are meeting with a fair measure of success in their bid for orders, and the industry presents a distinctly brighter outlook. At the moment works are actively employed, and have good orders in hand to ensure steady employment over the next few months. Conditions generally are in their favour, for on the Continent working costs are on the upward trend, and manufacturers here are in a much better position to counteract competition from that quarter. Moreover, with prices now only 15 to 20 per cent. above pre-war level, it seems to be not unreasonable to assume that some measure of stabilisation of prices has been reached, and business upon a more extended scale seems to be possible. During the past two or three years the continued decline in prices has kept buyers operating upon a purely hand-to-mouth policy, but now that prices are on a steadier basis, hopes are entertained that long term contracts will be arranged. This, of course, would ensure continuity of operations at the steel works, and thereby reduce works costs.

The Coal Trade.

Fairly active conditions prevail in the Northern coal trade, but this is mainly through the delayed movements occasioned by the recent storms, and fitters find that while exporters are inquiring briskly for supplies, definite business is difficult to attract, and as orders are being cleared off there is not much new business to take their place. On the Continent, particularly in Belgium and Holland, waterways are still frozen, and shipments from this side are consequently held back. From France and Italy the demand under old contracts is brisk, but new business comes forward slowly, so that prices are showing a somewhat sagging tendency. Direct best Northumberland steams adhere to late figures, but second-hand holders are less sure of their immediate custom, and therefore prices are easy. There are offers to sell at 13s. over the year, but buyers are hesitating at that figure, and, in the main, believe that it will go lower. Second steams are fairly steady at 12s. to 12s. 3d., but smalls are less active than they have been. Durham gas coals fluctuate somewhat, though primary grades find a good demand at current

figures. Second qualities are perhaps a shade easier. Coking coals indicate little improvement. For good average kinds the price is 13s. 6d. to 13s. 9d. Durham unscreened bunkers are offered freely, but prices are fairly steady. Good qualities command 13s. 3d., and best kinds 13s. 9d. to 14s. 6d. There is a good market for coke, and all lots for early shipment command full prices. Gas coke for prompt is 23s. 6d., and forward 23s. Patent oven cokes are firm, and supplies scarce at 17s. 6d. to 18s. for best makes.

Blast-furnacemen's Wages.

Blast-furnacemen on the North-East Coast have suffered another reduction in wages as a result of a fall in the realised price of Cleveland pig iron. The average net selling price of No. 3 quality, which governs wages, for the last quarter of 1927, was certified this week to have been 64s. 7·04d. per ton, as compared with 68s. 9d. per ton for the preceding quarter. In accordance with the sliding scale arrangement the wages of blast-furnacemen have been reduced by 2·5 per cent., bringing them down to 10·5 per cent. above the standard. The ascertained price is the lowest recorded since 1915. Since July last the men's wages have dropped by 13·5 per cent.

Cleveland Ironstone Miners' Wages.

A 2·5 per cent. reduction has been made in Cleveland ironstone miners' wages. Under the recognised formula the mineowners were entitled to claim a much bigger reduction, but refrained from a strict enforcement of the sliding scale. Since April last the Cleveland miners have suffered reductions in wages aggregating 18·5 per cent. Their wages are now 55·5 per cent. above the base rate.

SCOTLAND.

(From our own Correspondent.)

Partial Resumption.

THE quietness in several branches of industry has caused an extension of the New Year holidays, and many concerns will not resume operations until Monday, January 16th. Consequently, owing to this partial resumption of operations, markets are still more or less inactive.

Steel and Iron.

While many of the large steel works remain idle, one or two of the Lanarkshire concerns are again working on orders urgently required. At least one of the big steel works has prospects of employment for a considerable period. The demand for heavy material, however, is most disappointing, and any accumulation of orders during the holidays is said to be very small in comparison with former periods. The ironworks are similarly situated, and few, if any, are yet in operation.

Pig Iron.

For some considerable time the demand for Scottish pig iron has been most unsatisfactory. Prices have steadily declined since February of last year, while business has not shown the slightest improvement, due, in a measure, to severe competition. Under present oncost charges, the level to which prices had fallen was deemed barely remunerative, and for a time a further reduction in output was foreshadowed. Consequently, it is no surprise to find the number of furnaces in operation reduced from thirty-one to twenty-six; while a continuance of recent conditions must inevitably bring a further curtailment.

Exports and Imports.

During the past week 11,200 tons of iron ore were discharged at Glasgow. Iron and steel imports totalled 2100 tons. Shipments of iron and steel products amounted to 5800 tons, and fair quantities of machinery, tubes and structural material were also dispatched.

Coal.

Before the end of this week the restart at the collieries should bring employment well up to the level pertaining prior to the New Year holidays. In Fifeshire and the Lothians the resumption has been more rapid than in the other districts. So far as business is concerned, the market remains comparatively inactive. Supplies are scarce and prices upheld, and shippers, not being inclined to pay the current rates, are holding off meantime. Shipments amounted to 132,371 tons, against 242,533 tons in the preceding week and 133,214 tons in the same week last year. The home market continues under the holiday influence.

Central Scotland Coal Pits.

The outlook for the coal industry in Western Stirlingshire and Eastern Dumbartonshire is very far from satisfactory. In these areas the restart has been delayed, and notices which have been posted state that work may be resumed next week. In East Lothian about 18,000 miners are unemployed, and as there appears little prospect of an early improvement, many of the men, it is said, contemplate emigrating to Canada in the springtime.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Conditions.

OPERATIONS in steam coals have not expanded to any material extent during the past week, and altogether the conditions provide no special feature. There are one or two inquiries on account of the Greek State Railways and the Spanish Railways and Navy, but the quantities are comparatively small. Business all round is by no means active, though some of the leading collieries are well sold, and have a good deal of tonnage on stem for the next few weeks. At the same time, exporters view with some perturbation the volume of shipments from Rotterdam and the quantity of German coals which is being shipped, for Italy especially. The conditions in the coal trade here might be better if tonnage came along as arranged, but many collieries are still suffering on account of the fact that bad weather has interfered with the movement of steamers, though this is not to say that collieries are prepared to quote any lower prices for their coals even though they may be in temporary difficulties. Shipments for the week ended the 6th inst. were certainly better than for the previous week, the total being just over 374,000 tons, as against rather more than 242,000 tons, but the last week in December was an extremely bad one. In fact, the returns for the whole of the month of December were very unfavourable, and were the worst for any month during 1927. The consequence is that the total foreign exports for last year did not quite come up to expecations, and were approximately 22¼ million tons, as compared with 9,295,000 tons for 1926, 21,454,000 tons for 1925, and 29,876,000 tons for 1913. Chartering during the past week has been rather more active, but it is very evident that there must be a considerable expansion of operations if the conditions in the coal trade are to show any real improvement.

Coal Stabilisation Scheme.

South Wales coalowners met at Cardiff on Thursday last week for the purpose of hearing the report of the committee and to consider the proposed scheme for the stabilisation of coal prices. Details were given regarding the grouping of the collieries, the classification of coals and the fixing of minimum prices, after which members discussed the position, but no actual decision was come to. Opinions were, of course, freely expressed, and it was eventually arranged that the particulars respecting the proposed grouping of collieries, prices, &c., should be issued to the colliery companies, so that each undertaking could then submit its suggestions. Later meetings of representatives of the collieries in each group will be held, to be followed by a general meeting of the whole of the colliery representatives at the end of the month, by which time it is expected that the formation of the new association will be completed. The meeting on Thursday of last week represented approximately 90 per cent. of the Welsh coalfield output. It is understood that the promoters of the stabilisation scheme are very optimistic that they will have sufficient support from the coalowners generally to enable the scheme to be put into operation successfully, though it is obvious that it cannot be introduced at the earliest before February.

Coal Trimmers' Hours.

It will be recalled that the coal trimmers and tippers recently made an application for an alteration of the working hours at South Wales docks. Their idea is to do away with night work and to revert to the hours formerly in force, viz., to have two continuous shifts during the day. The employing interests opposed the suggestion, as they contended that the present system of a day and a night shift had given good results. The matter was therefore referred to the National Coal Trimming Board, which body met in London last week, but no decision was come to, except that the matter should be referred to a subcommittee of four, viz., two representatives of the employers' and two from the workmen's side.

Coalfield Items.

The workmen, numbering about 2500, employed at the Bedwas collieries recently received notices terminating their contracts, owing to the adverse state of trade. These notices run out at the end of this week, but strenuous efforts are being made by the miners' leaders, and hopes are entertained that it may be possible to avert the closing down of the colliery. The Powell Duffryn Company tendered on Monday notices to 1500 workmen at its Bargoed South steam coal pit. The North pit has been idle for some time, but in the case of the South pit notices have been served to enable developments to take place. The intention of the company is to sink the North and South pits to the lower seams, and this will take about three months, at the end of which time it is hoped to employ more men than ever.

Railway and Dock Charges.

The Executive Council of the South Wales Miners' Federation decided on Monday to adopt the suggestion of the Coalowners' Association that a joint subcommittee should be appointed to approach the Prime Minister for the purpose of directing his attention towards the difficulties in the mining industry, and particularly in regard to the high railway rates and dock charges.

Steel and Iron Trade.

Operations were resumed last week-end at all the blast-furnaces at Victoria belonging to the Ebbw Vale Company. This occasioned considerable satisfaction, as it was not expected that the steel works and other portions of the company's plant would re-commence so soon.

1927 Trade.

The G.W.R. traffic returns for the six docks under its control in South Wales show that for 1927 imports and exports aggregated 37,555,566 tons, which compares with 19,812,488 tons for 1926, the year of the national coal stoppage, and with 35,080,580 tons for 1925. Coal and coke shipments last year came to 27,880,816 tons, which compares with 11,297,668 tons for 1926 and with 26,403,466 tons for 1925.

Current Business.

New business has been quiet and the market remains without material change in any department. The position of individual collieries has varied considerably, for the reason that the bad weather has interrupted the movement of tonnage and caused many undertakings to suffer a substantial amount of inconvenience. Nevertheless, salesmen have not altered their prices to any appreciable extent. At the end of last week there were over thirty idle loading appliances at the various docks, but on Tuesday the number was reduced to twenty-nine, and it is hoped that the position in this respect will continue to improve, but this cannot be counted upon. Sized coals are relatively about the steadiest section of the market, and are in quite good demand.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

MESSRS. MERZ AND MCLELLAN ask us to make it clear that it is their Newcastle office only that has removed to Carliol House, Newcastle-upon-Tyne. Their London office remains at 32, Victoria-street, Westminster, S.W. 1.

ELECTRICARS, Ltd., asks us to announce that as from January 1st the address of its works, including its head and registered offices, has been changed from Landor-street to Lawley-street, Birmingham. Telephone number C. 8375/6, and telegraphic address "Elecomcar, Birmingham."

HORDELL, WAY AND CO., Ltd., 45, Church-street, Minories, London, E. 1, ask us to announce that they have taken over the sole selling rights in this country and the Colonies of the products Karnak, Krodeproof and Korkseal, manufactured by the Lewis Asphalt Engineering Corporation, of New York.

THOS. W. WARD, Ltd., of Sheffield, asks us to announce that it has acquired, for dismantling purposes, the plant of the Craven and Wyken Collieries, near Coventry, which, owing to adverse working conditions, said to be mainly due to excess of water and non-productive seams, have been closed down.

NEWTON, CHAMBERS AND CO., Ltd., of Thorncliffe Ironworks, near Sheffield, ask us to announce that they have appointed Mr. E. A. U. Ward, of the White Building, Fitzalan-square, Sheffield, as their agent in the Lancashire-South Yorkshire area for the products of the Thorncliffe centrifugal casting department.

MR. A. H. HALL, C.B.E., M. Inst. C.E., M.I.Mech. E., Superintendent of Airship Production, has been appointed Chief Superintendent of the Royal Aircraft Establishment, Farnborough, as from April 1st next, in succession to Mr. W. Sydney Smith, C.B., O.B.E., who is on that date retiring from the public service.

As a result of the fusion of certain of their interests with those of Vickers Ltd., Sir W. G. Armstrong, Whitworth and Co., Ltd. have decided to concentrate their activities at the following, establishments:—The Walker Group of Shipyards, Low Walker, Newcastle-upon-Tyne; the Scotswood Group of Works, Newcastle-upon-Tyne; the Close Works, Gateshead-upon-Tyne. The products of these establishments will be as follows:—The Shipyards: Passenger vessels of all types, cargo vessels, oil tankers, ice breakers, train ferries, lightships, crane barges, steel pontoons and special purpose craft of all types. Scotswood: Locomotives of all types (steam, Diesel and electric), locomotive boilers, locomotive spare parts (including forgings, brasswork, built wheels and axles, and rough or finished axles), screw and automatic couplings, Armstrong-Sulzer marine Diesel engines, marine steam reciprocating engines, marine steam turbines (impulse and reaction types with single or double reduction gears), marine engine spare parts, marine boilers and fittings, marine condensing installations of all types, general engineering. Close Works: Locomotive castings (cylinders and general), marine engine castings for steam and Diesel engines and turbines of all types, general castings up to 32 tons in weight, mass production machine moulded castings, high-pressure hydraulic pipes and valves, hydraulic cylinders and rams, refined pig irons to guaranteed analyses, pattermmaking in all branches.

LAUNCHES AND TRIAL TRIPS.

PACHECO, motor vessel; built by Harland and Wolff, Ltd., to the order of MacAndrews and Co., Ltd.; dimensions, 270ft. by 39ft. by 17ft. 6in.; 1345 gross tonnage. Engines, six-cylinder, single-acting motor; constructed by the builders; trial trip, December 22nd.

SAN CLAUDIO, twin-screw steamer; built by Sir W. G. Armstrong, Whitworth and Co., Ltd., to the order of the Eagle Oil Transport Company, Ltd.; dimensions, 316ft. by 51ft. by 15ft. Engines, twin-screw, inverted direct-acting, triple-expansion, 14in., 23in., 38in. diameter by 24in. stroke, pressure 180 lb.; constructed by the Shields Engineering and Dry Dock Company, Ltd.; launch, December 23rd.

ST. THERESE, single-screw cargo steamer; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of Jons Lund and Co., Tonsberg; dimensions, 292ft. by 44ft. by 21ft. 6in. Engines, triple-expansion; constructed by George Clark, Ltd.; launch, January 5th.

INDUSTRIAL WELFARE.—A conference, convened by the Industrial Welfare Society, is to be held at the Hotel Metropole, Northumberland-avenue, on Friday, January 27th, 1928, the subject to be discussed being "Accident Prevention." In the morning at 11 o'clock papers will be read by (*a*) Mr. James Smith, of Beyer, Peacock and Co., Ltd., on "Accident Prevention: Works Discipline and Co-operation," and (*b*) Mr. Bernard L. Lelliott, of the Associated Portland Cement Manufacturers, Ltd., on "The Competitive Spirit in Accident Prevention." A discussion will follow. In the afternoon at 2.45 a visit will be paid to the Home Office Industrial Museum, Horseferry-road, Westminster. Applications for tickets should be made to the Industrial Welfare Society, 51, Palace-street, Westminster, S.W. 1.

BRITISH MARKET FOR SOUTH AFRICAN GOODS.—At a meeting of the British Empire Producers' Organisation, held on January 4th, representatives of the leading British locomotive manufacturers attended, by invitation, to discuss the position which has arisen owing to the recent placing of large orders for locomotives by the South African Government in Germany, and the serious reaction that the pursuit of a policy of this kind might create against South African products in the British market. Having obtained full information concerning the British tenders and conditions, the Organisation decided to cable to its affiliated bodies in South Africa impressing upon them the grave effects on the British market that would follow the continuation of such a policy for South African goods. The meeting was presided over by Mr. Ben H. Morgan, Chairman of the Council of the British Empire Producers' Organisation. Among the locomotive firms represented were Sir W. G. Armstrong, Whitworth and Co., Ltd., Avonside Engine Company, Ltd., W. G. Bagnall, Ltd., Andrew Barclay, Sons and Co., Ltd., Hawthorn, Leslie and Co., Ltd., Hudswell, Clarke and Co., Ltd., Hunslet Engine Company, Ltd., Kitson and Co., Ltd., Nasmyth, Wilson and Co., Ltd., North British Locomotive Company, Ltd., Robert Stephenson and Co., Ltd., Vulcan Foundry, Ltd., Yorkshire Engine Company, Ltd.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
Native	18/6 to 21/–
(1) Spanish	18/6 to 21/–
(1) N. African	18/6 to 21/–
N.E. COAST—	
Native	18/– to 21/–
Foreign (c.i.f.)	21/–

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	3 14 0	—
No. 1 Foundry	3 15 0	—
No. 3 Foundry	3 10 0	—
N.E. COAST—		
Hematite Mixed Nos.	3 10 0	3 10 0
No. 1	3 10 6	3 10 6
Cleveland—		
No. 1	3 7 6	3 7 6
Silicious Iron	3 7 6	3 7 6
No. 3 G.M.B.	3 5 0	3 5 0
No. 4 Foundry	3 4 0	3 4 0
No. 4 Forge	3 3 6	3 3 6
Mottled	3 3 0	3 3 0
White	3 3 0	3 3 0
MIDLANDS—		
(3) Staffs.—		
All-mine (Cold Blast)	—	—
North Staffs. Forge	—	—
,, ,, Foundry	3 4 6 to 3 6 0	—
(3) Northampton—		
Foundry No. 3	3 0 0 to 3 1 0	—
Forge	2 14 0	—
(3) Derbyshire—		
No. 3 Foundry	3 5 0 to 3 6 0	—
Forge	2 19 0	—
(3) Lincolnshire—		
No. 3 Foundry	3 4 0 to 3 5 0	—
No. 4 Forge	3 2 6	—
Basic	3 2 6	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 2 0 (*a*); 4 5 0 (*b*); 4 8 6 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	10 0 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 5 0	—
Common Bars	10 5 0	—
Best Bars	10 15 0	—
LANCS.—		
Crown Bars	10 0 0	—
Second Quality Bars	9 10 0	—
Hoops	12 10 0	—
S. YORKS.—		
Crown Bars	10 10 0	—
Best Bars	11 15 0	—
Hoops	12 10 0	—
MIDLANDS—		
Crown Bars	9 5 0 to 10 5 0	—
Marked Bars (Staffs.)	12 10 0	—
Nut and Bolt Bars	9 0 0	—
Gas Tube Strip	11 10 0	—

STEEL. (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	10 10 0	10 10 0
Ship Plates, ¾in. and up	8 2 6	7 12 6
Sections	7 12 6	7 2 6
Steel Sheets, ¼in.	8 17 6	8 15 0
Sheets (Gal. Cor. 24 B.G.)	13 12 6	13 5 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 2 6	—
Angles	7 12 6	—
Boiler Plates	12 10 0	—
Joists	7 12 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	8 2 6	—
Soft Billets	7 5 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 5 0	—
Light Rails	8 10 0 to 8 15 0	—
Billets	7 10 0 to 10 0 0	—
MANCHESTER—		
Bars (Round)	8 10 0	—
,, (Small Round)	7 10 0	—
Hoops (Baling)	10 5 0	10 0 0
,, (Soft Steel)	9 0 0	8 15 0
Plates	8 7 6	—
,, (Lancs. Boiler)	10 5 0	—
SHEFFIELD—		
Siemens Acid Billets	10 0 0	—
Hard Basic	7 12 6 to 8 2 6	—
Intermediate Basic	7 10 0	—
Soft Basic	6 10 0	—
Hoops	10 0 0 to 10 10 0	—
Soft Wire Rods	9 0 0	—
MIDLANDS—		
Small Rolled Bars	7 7 6 to 8 0 0	—
Billets and Sheet Bars	6 0 0 to 6 5 0	—
Sheets (20 W.G.)	11 10 0 to 12 0 0	—
Galv. Sheets, f.o.b. L'pool	13 0 0 to 13 5 0	—
Angles	7 12 6	—
Joists	7 12 6	—
Tees	8 12 6	—
Bridge and Tank Plates	8 7 6	—
Boiler Plates	11 0 0 to 11 10 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	18/– to 18/6
Block Tin (cash)	254 10 0
,, (three months)	254 0 0
Copper (cash)	61 13 9
,, (three months)	61 11 3
Spanish Lead (cash)	21 17 6
,, (three months)	22 5 0
Spelter (cash)	26 2 6
,, (three months)	25 17 6
MANCHESTER—	
Copper, Best Selected Ingots	66 15 0
,, Electrolytic	67 5 0
,, Strong Sheets	92 0 0
,, Tubes (Basis Price), lb.	0 1 0¾
Brass Tubes (Basis Price), lb.	0 0 11¾
,, Condenser, lb.	0 1 1¾
Lead, English	23 7 6
,, Foreign	22 7 6
Spelter	26 5 0
Aluminium (per ton)	£107

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/8 per lb.	
Ferro Tungsten	1/4 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 0 0	7/6
,, ,, 6 p.c. to 8 p.c. ,,	£22 17 6	7/3
,, ,, 8 p.c. to 10 p.c. ,,	£22 10 0	6/6
,, ,, Specially refined		
,, ,, Max. 2 p.c. carbon	£36 0 0	11/6
,, ,, ,, 1 p.c. carbon	£41 10 0	15/–
,, ,, ,, 0·70 p.c. carbon	£53 0 0	17/6
,, ,, ,, carbon free	1/4 per lb.	
Metallic Chromium	3/– per lb.	
Ferro Manganese (per ton)	£13 0 0 for home; £12 for export	
,, Silicon, 45 p.c. to 50 p.c.	£12 15 0 scale 5/– per unit	
,, ,, 75 p.c.	£20 5 0 scale 6/– per unit	
,, Vanadium	14/3 per lb.	
,, Molybdenum	5/– per lb.	
,, Titanium (carbon free)	0/11½ per lb.	
Nickel (per ton)	£175	
Ferro-Cobalt	9/3 per lb.	

FUELS.

SCOTLAND.

(*Prices not stable.*)

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	14/–
,, ,, Ell	14/9
,, ,, Splint	17/6 to 18/–
,, ,, Trebles	14/6
,, ,, Doubles	14/– to 14/3
,, ,, Singles	11/9
AYRSHIRE—	
(f.o.b. Ports)—Steam	13/3
,, ,, Jewel	15/6
,, ,, Trebles	14/6
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	12/– to 13/–
Screened Navigation	18/–
Trebles	14/9 to 16/–
Doubles	14/3
Singles	11/9
LOTHIANS—	
(f.o.b. Leith)—Best Steam	12/9
Secondary Steam	12/3
Trebles	14/6
Doubles	14/6
Singles	11/9

ENGLAND.

(8) N.W. COAST—	
Steams	24/– to 25/–
Household	37/6 to 50/–
Coke	23/– to 24/–
NORTHUMBERLAND—	
Best Steams	13/6 to 14/–
Second Steams	12/– to 12/3
Steam Smalls	9/– to 9/9
Unscreened	13/– to 13/6
Household	21/– to 27/–
DURHAM—	
Best Gas	15/6 to 16/–
Second	13/9 to 14/–
Household	21/– to 27/–
Foundry Coke	19/– to 26/–

SHEFFIELD—	Inland.	Export.
Best Hand-picked Branch	27/6 to 29/6	—
Derbyshire Best Bright House	20/6 to 21/6	—
Best House Coal	19/– to 20/6	—
Screened House Coal	16/– to 17/6	—
,, ,, Nuts	15/– to 16/–	—
Yorkshire Hards	14/6 to 15/6	—
Derbyshire Hards	14/– to 15/6	—
Rough Slacks	8/6 to 9/6	—
Nutty Slacks	6/– to 7/–	—
Smalls	3/– to 4/6	—
Blast-furnace Coke (Inland)	13/– at ovens	—
Furnace and Foundry Coke (Export), f.o.b.		18/– to 18/6

(9) SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Smokeless Large	19/– to 19/6
Second Smokeless Large	18/6 to 19/–
Best Dry Large	18/3 to 18/9
Ordinary Dry Large	17/6 to 18/–
Best Black Vein Large	17/6 to 18/–
Western Valley Large	17/– to 17/6
Best Eastern Valley Large	17/– to 17/3
Ordinary Eastern Valley Large	16/6 to 17/–
Best Steam Smalls	12/6 to 13/3
Ordinary Smalls	11/– to 12/6
Washed Nuts	18/– to 22/–
No. 3 Rhondda Large	19/6 to 20/–
,, ,, Smalls	14/9 to 15/3
No. 2 ,, Large	16/– to 16/6
,, ,, Through	14/6 to 15/6
,, ,, Smalls	12/6 to 13/6
Foundry Coke (export)	30/– to 35/–
Furnace Coke (export)	27/6 to 30/–
Patent Fuel	22/6 to 24/–
Pitwood (ex ship)	28/– to 28/6
SWANSEA—	
Anthracite Coals:	
Best Big Vein Large	30/– to 32/6
Seconds	25/6 to 29/–
Red Vein	20/6 to 25/–
Machine-made Cobbles	35/– to 40/–
Nuts	38/6 to 42/6
Beans	22/6 to 27/6
Peas	17/– to 18/6
Breaker Duff	8/6 to 9/–
Rubbly Culm	8/– to 8/6
Steam Coals:	
Large	17/6 to 18/6
Seconds	16/– to 17/–
Smalls	10/– to 11/–
Cargo Through	15/– to 16/–

(1) Delivered. (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire. (6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/– extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate 7/6 joists and 5/– all other materials if home consumers confine purchases solely to British products.

French Engineering Notes.

(*From our Correspondent in Paris.*)

The Steel Trade.

THE negotiations for the constitution of the *comptoir* for the sale of girders are reported to have been brought to a successful conclusion, and some progress is being made with the *comptoir* for sheets and plates which, it is hoped, will be definitely formed at an early date. This step has so far strengthened the position of producers that they have been able to dispose of some of their stocks, many buyers having been induced to make purchases in view of a probable rise in prices, but while it has hardened the situation generally, it has not brought about a stable improvement, and there can be no permanent increase in activity until more steel goes into consumption. Nevertheless, there is confidence in the future, and it is believed that the country is so far emerging from its financial troubles that the time is not far distant when trade will take a turn for the better. While it is probable that higher prices will be fixed by the *comptoir*, that does not mean that the competition for export business will be less severe. In many cases foreign orders have been taken at prices leaving so small a margin of profit that very little is made out of them, and the object of producers in endeavouring to obtain higher prices on the home market is to place them in a more favourable position for doing an export trade. The ability of French mill and forge owners to compete in foreign markets will be lessened by the home demand absorbing the greater part of the production, but more particularly by the higher charges which, it is feared, will be imposed upon manufacturers by the increased railway rates that the companies are asking for permission to put into force, and also by the heavier taxation resulting from the application of the new social legislation. This heavier burden is a serious matter for firms which have to rely, at present, upon the foreign trade.

Metallic Coaches.

In the construction of all-metal coaches, from which wood is entirely excluded, the railway companies have found themselves confronted with the problem of building specially strong vehicles which may be expected to resist telescoping in the event of collision, to be free from rattle and vibration, and to weigh less than 500 kilos. per seated passenger. They must also be reasonably non-conducting as regards heat and cold. As girder construction is out of the question the new coaches on the Chemins de Fer du Nord are, apart from the frames, made entirely of pressed steel plate. The sides are built up of sections of 4 mm. plate pressed with openings for a door and two windows and the sections are riveted and welded together. The compartments are formed of 3 mm. sheet steel pressed into rectangular shape and riveted and welded to the sides and floor, while a curved section in aluminium is riveted and welded at the top to form the roof. Aluminium and its alloys are employed wherever possible, notably for the doors. At each end of the coach the transversal sections are made specially strong to resist shocks. The floor is constituted of corrugated galvanised iron laid on the girder frame and covered with a resilient and non-conducting material. The new coaches can each seat ninety passengers and their appearance is neat and pleasing, while it is stated that the vehicles are turned out rapidly and at relatively low cost.

Steel Houses.

The increasing employment of armoured concrete for structural purposes, even for bridges of considerable span, the latest being the bridge across the estuary of the Elorn at Plougastel, near Brest, with three spans of 190 m., is an important factor in the crisis which has overtaken the steel industry. For some time it was hoped that the vogue of armoured concrete would give way to a renewed application of steel for structural work, but, so far, there appears to be no sign of such a reaction taking place, and steel makers are therefore endeavouring to find new sources of consumption, particularly in the use of steel for house building. A group of mill and forge owners accordingly organised a competition amongst architects for the best designs of all-steel houses in the hope that the designs presented and the economy of construction would popularise a method of building that would help to remedy the house shortage, and provide a new outlet for steel products.

Tidal Power Schemes.

While the experimental tidal power station at Aber W'rach, near Brest, is making slow headway, another project is being put forward by a syndicate at Amiens, which proposes to create a station in the Bay of the Somme where the amplitude of the tides is declared to be sufficient for the purpose. The scheme, which has received the approval of the Chamber of Commerce of Abbeville, is said to be capable of producing a continuous supply of electrical energy varying from 40,000 to 120,000 horse-power. It was only possible to put the Aber W'rach installation in hand with the aid of a State subsidy. Until that venture shows definite results it is doubtful whether sufficient private financial aid will be forthcoming for a new scheme. Moreover, the attempts to utilise tidal power only seem justified in cases in which there is no local supply of energy, and the electrification schemes now being carried out in the Alps, Pyrenees and Massif Central, in conjunction with thermal plants in the Loire, Paris and the Nord, are intended to provide the whole country with energy, with the possible exception of Brittany, which is far away from the sources of supply. As the range of tides on the Brittany coast is far greater than elsewhere, it is only natural that an effort should be made to utilise a fraction of the energy available, especially where the coast permits of arrangements being made to store water against a falling tide, and the experimental Aber W'rach scheme, in which the tides and the river are employed to produce a continuous supply, offers a reasonable chance of producing satisfactory results, but it will only be the first stage of an experiment which will be continued for, probably, many years before definite data can be acquired concerning the economy and practical character and the limitations of tidal power schemes.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

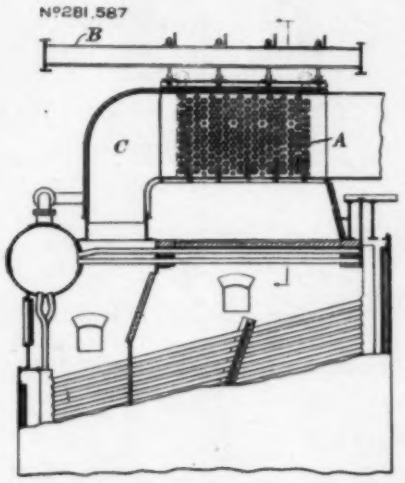
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM GENERATORS.

281,587. May 3rd, 1927.—ECONOMISERS FOR WATER-TUBE BOILERS, *T. E. Robertson*, 43, *Southampton-buildings, Chancery-lane, London, W.C.* 2.

In this specification claim is made more for the relative disposition of the economiser and the boiler than for the actual form of construction. The aims are to reduce radiation losses

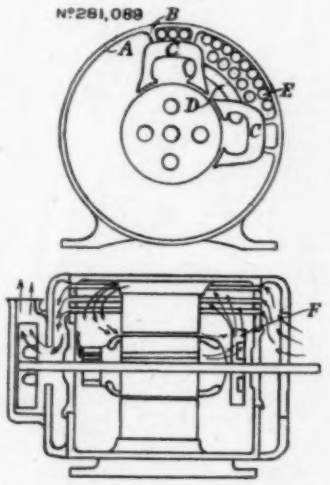


and to provide a compact arrangement. The economiser A is consequently placed immediately above the boiler, and is supported by an external framework B. The flue gases from the boiler are conducted to it, by a short duct C, and the width of the economiser is preferably equal to that of the boiler.—*December 8th*, 1927.

DYNAMOS AND MOTORS

281,089. November 25th, 1926.—IMPROVEMENTS IN DYNAMO-ELECTRIC MACHINES, The Electro Dynamic Construction Company, Ltd., and Nicolo Pensabene, of, 6, Malt-street, London, S.E. 1.

This invention relates to the construction of direct-current dynamos and motors of the totally enclosed type, and its object is to provide means whereby, for a given weight and temperature rise, a larger output can be obtained than usual. The case A of

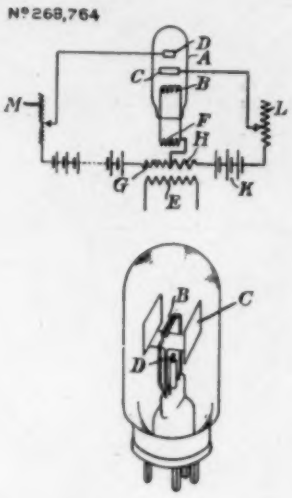


the machine has projecting ribs B which support magnetic sections C, and two adjacent half sections form a magnetic pole split in the centre. The field coils are shown at D and there are as many of these coils as there are magnetic poles. Between the various sections C cooling tubes are provided, as shown at E. Inside the case a fan F drives hot air through the armature and commutating poles and throws it outwards so as to impinge on the cooling tubes.—*December 1st*, 1927.

ELECTRICAL APPLIANCES.

268,764. March 24th, 1927.—IMPROVEMENTS IN OR RELATING TO RECTIFIERS FOR ALTERNATING CURRENT, Accumulatoren-Fabrik Aktiengesellschaft, of No. 3, Askanischer Platz, Berlin, S.W. 11.

The system of connections illustrated is adapted for charging two batteries by means of a valve. A is the valve having a glowing cathode B, and the two anodes C and D. E is the primary winding of a transformer. F is the secondary heating winding for the glowing cathode and G and H are the secondary windings traversed by the uni-directional currents. K is one of the batteries to be charged. L and M are the resistances for controlling the charging currents. The glowing cathode B is connected to the common point of the two secondary windings G and H, while the free ends of the windings are connected through the batteries and the resistances L and M respectively to the anodes C and D. One half of the alternating current serves for charging the battery K, while the other half serves for charging the other battery. The lower illustration shows a valve constructed according to the invention. The glowing cathode B is in the form of a helix embraced by the larger

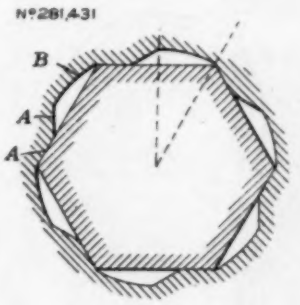


anode C, which is made from a sheet of metal bent at right angles at two points, the middle part being narrower than the upturned parts. The smaller anode D is formed by a wire, of which only the point projects from an enclosing quartz tube. The narrower part of the larger anode C lies between the point of the anode D and the cathode B.—*December 1st*, 1927.

MACHINE TOOLS AND SHOP APPLIANCES.

281,431. October 6th, 1926.—SPANNERS, J. V. Pugh and Rudge-Whitworth, Ltd., Crow-lane, Coventry.

The inventors argue that the ordinary spanner is unsatisfactory in that it has to be made with a considerable clearance to adapt itself to the errors in manufacture of the nuts, with the result that the spanner bears only on the corners of the nut and

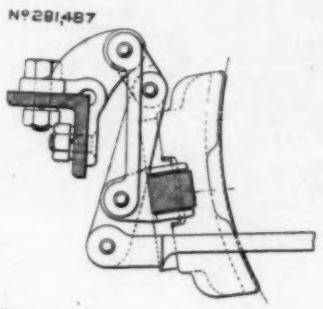


damages them. As a consequence, they propose to make spanners as shown in the drawing. That is to say, with short engaging facets A A connected by curved faces B. The spanner can easily be slipped on to the nut and has the merit that it can be used to knock the nut round with the help of its own inertia.—*December 8th*, 1927.

TRAMWAYS AND RAILWAYS.

281,487. December 28th, 1926.—BRAKE GEAR, The Electro-Mechanical Brake Company, Ltd., J. H. Williamson, L. A. Catlin, and G. N. Cadbury, Eagle Works, West Bromwich.

In order to prevent the "chattering" of brakes when applied to their wheels, the inventors hang the brakes on a double set



of links, as shown in the drawing. It will be seen that when the brake is pulled on, a toggle action is set up which takes up any slack in the pin joints and gives a rigid support to the shoe.—*December 8th*, 1927.

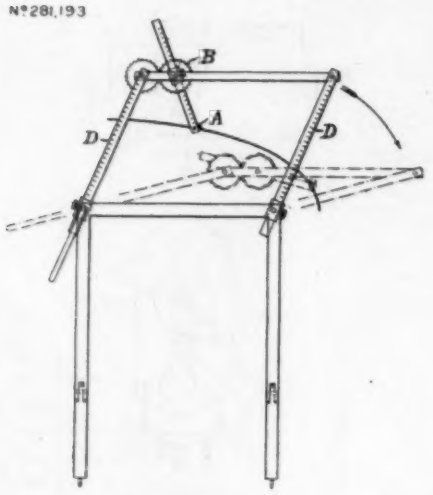
MISCELLANEOUS.

281,193. July 17th, 1927.—DRAWING STRAIGHT OR CURVED LINES, C. H. Dearing, The Bungalow, Church-lane, Runwell, Essex.

This invention relates to apparatus for drawing lines which may be of any desired curvature between and including a circle and a straight line, but the apparatus is intended primarily for drawing ellipses, which may be of any size and of which the major and minor axes may be of any desired ratio to one another. The apparatus consists essentially of a parallelogram having relatively movable arms, to one of which is connected an additional adjustable arm carrying a pencil or the like at one

extremity. Movement is transmitted to the pencil-carrying arm by means of gear wheels rotated by means of a handle integral with or connected to one of the movable arms of the parallelogram. The apparatus is supported partly by the pencil and partly by a framework that rests on the paper or drawing board, and preferably consists of two hinged arms pointed at their outer ends and adapated to dig into the paper or drawing board. If the device be set so that the pencil A is beneath the centre of

N°281,193



the wheel B it will draw a circle. If, on the other hand, a straight line is to be drawn the arm B should be adjusted so that the distance of the pencil from the centre of the wheel B is equal to the length of either of the arms D. If the pencil is set at any other position it will draw an ellipse, the ratio of the major axis to the minor axis depending upon the relative length of the arms D and the distance of the pencil from the centre of the wheel B.—*December 1st*, 1927.

280,776. March 10th, 1927.—PAPER-MAKING MACHINES, R. Marx, 25, Finsbury-square, London, E.C. 2.

It is, of course, well known, says the patentee, that the passage of a current of warm or unsaturated air over a sheet of paper accelerates drying. He consequently proposes to furnish the

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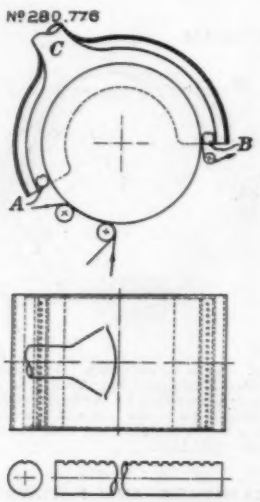
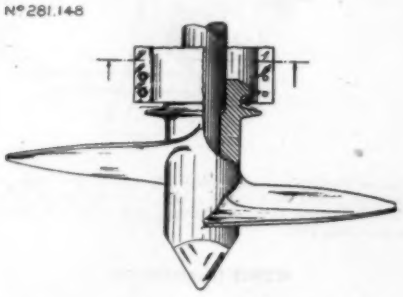


terminal drying cylinders of a paper-making machine with circumferential hoods, as indicated in the drawing, with hot air supply pipes at A and B, and an outlet at C. It is suggested that the hood may be either heat insulated or jacketed to reduce the loss of heat to the atmosphere.—*November 24th*, 1927.

281,148. March 17th, 1927.—SCREW PILE DRIVING, Braithwaite and Co., Engineers, Ltd., Broadway Buildings, Westminster; and R. Freeman.

This invention relates to a process of screw piling wherein the finished pile takes the form of a concrete pillar. Broadly, the apparatus consists of a screw boring head which is rotated by means of a power-driven shaft capable of being withdrawn from engagement with the head when the required penetration has

N°281,148

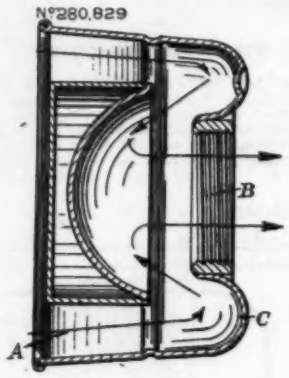


been effected. The boring head carries behind it a relatively thin-walled shell or tube, of diameter equal to that of the finished pile, through which the driving shaft passes axially. The shell is mounted on the boring head in such a manner as to follow the latter in its penetration of the soil, but preferably so as not to rotate with it. On attaining the predetermined depth the driving shaft is withdrawn from the head, which is left in position, and the shell is filled with concrete or other suitable cementitious aggregate. In this manner a pile is produced having the permanence and cheapness of the concrete shaft combined with the large bearing capacity of the pile screw head. The load which can be safely carried by the pile is determined by the area of the screw head, which is equivalent to a base of large bearing surface resting on the subsoil. Among other advantages claimed for the process may be mentioned economy of power owing to the rotating driving shaft being shielded from engagement with the surrounding earth during the screwing.—*December 1st*, 1927.

280,829. July 21st, 1927.—AIR CLEANERS FOR INTERNAL COMBUSTION ENGINES, Imperial Chemical Industries, Ltd., and W. Comery, 64, Broadway-buildings, Westminster.

The idea of this invention is to eliminate the atmospheric dust from the induction air of internal combustion engines. The air

N°280,829



is sucked in through the annular space A and goes away by the central orifice B. In the annular space there are arranged vanes which give a vortical motion to the air. It is claimed that dust will be deposited in the reflex curve at C, but no hint is given as to how it should be removed as deposited.—*November 24th*, 1927.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

CHEMICAL ENGINEERING GROUP.—Chemical Society's Rooms, Burlington House, Piccadilly, London, W. 1. Paper, "The Manufacture of Artificial Silk, with Special Reference to Viscose," by Mr. H. R. S. Clotworthy. 8 p.m.

INSTITUTION OF ENGINEERING INSPECTION.—Royal Society of Arts, John-street, Adelphi, London, W.C. 2. Lecture, "Some Interesting Points in the Operation of Dielectrics," by Mr. P. Dunsheath. 7.30 p.m.

KEIGHLEY ASSOCIATION OF ENGINEERS.—Room 14, Temperance Institute, Keighley. Lecture, "The Heating of Mills and Workshops," by Mr. F. Watson. 7.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, London, S.W. 1. Paper, "Air Conditioning—a General Survey of its Uses and Application," by Mr. N. E. Jackson. 7.30 p.m.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—Mining Institute, Newcastle-upon-Tyne. Paper, "Diesel Engine Drive for Generators and Other Auxiliary Machinery on Board Ship," by Mr. J. Calderwood. 6 p.m.

SATURDAY, JANUARY 14TH.

INSTITUTE OF BRITISH FOUNDRYMEN: LANCASHIRE BRANCH, JUNIOR SECTION.—College of Technology, Sackville-street, Manchester. Lecture, "Cast Iron," by Mr. F. J. Cook. 7 p.m.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Eastern District meeting at West Ham. 10.45 a.m.

MONDAY, JANUARY 16TH.

INSTITUTION OF AUTOMOBILE ENGINEERS: SCOTTISH CENTRE.—Royal Technical College, Glasgow. Paper, "Experiments on the Behaviour of Various Gaseous Fuels in a High-speed Internal Combustion Engine," by Dr. A. F. Burstall. 7.30 p.m.

RAILWAY CLUB.—25, Tothill-street, London, S.W. 1. Paper, "Timetables, Old and New," by Lieut.-Colonel W. R. Mansfield. 7.30 p.m.

ROYAL SOCIETY OF ARTS.—John-street, Adelphi, London, W.C. 2. Cantor Lecture, "The Scientific Foundations of the Refining of Petroleum," by Dr. A. E. Dunstan. 8 p.m.

TUESDAY, JANUARY 17TH.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Broadgate Café, Coventry. Coventry Graduates' meeting. Paper, "A Survey of Aero-engine Design," by Mr. A. R. Gay. 7.15 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS: WOLVERHAMPTON CENTRE.—Engineering and Scientific Club, Queen-street, Wolverhampton. Paper, "The Electrical Characteristics of Spark Gap and Sparking Plugs," by Mr. E. A. Watson. 7.30 p.m.

MANCHESTER GEOLOGICAL AND MINING SOCIETY.—Queen's Chambers, 5, John Dalton-street, Manchester. Papers: "The Effects of Pillar and Stall Mining Under a Sandstone Roof," by Professor Owen T. Jones; "The Practical Solution of the High-temperature Deep-mining Problem," by Mr. A. Miller. 4 p.m.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS: MIDDLESBROUGH BRANCH.—Cleveland Scientific and Technical Institution, Middlesbrough. Paper, "Diesel Engine Drive for Generators and other Auxiliary Machinery on Board Ship," by Mr. J. Calderwood. 7.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. "Dielectrics for Electrical Condensers," by Mr. P. R. Coursey. 5.15 p.m.

WEDNESDAY, JANUARY 18TH.

BOROUGH POLYTECHNIC INSTITUTE.—Borough-road, London, S.E. 1. Annual prize distribution by the Right Hon. Lord Montagu of Beaulieu. 7 p.m.

INSTITUTE OF METALS: SWANSEA LOCAL SECTION.—Thomas Café, High-street, Swansea. "Some Interesting Properties of Alloys of Nickel," by Mr. W. T. Griffiths. 7 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Chamber of Commerce, New-street, Birmingham. Birmingham Graduates' meeting. Paper, "The Agent," by Mr. H. Warner. 7.30 p.m.

INSTITUTION OF CIVIL ENGINEERS.—Great George-street, Westminster, London, S.W. 1. Students' meeting. Vernon Harcourt Lecture, "Appliances for Handling Goods in Ports and Docks," by Mr. H. A. Reed. 6.30 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS: SOUTH MIDLAND CENTRE.—The University, Edmund-street, Birmingham. Paper, "Large Electric Baking Ovens," by Mr. W. Ellerd-Styles. 7 p.m.

NEWCOMEN SOCIETY.—Prince Henry's Room, 17, Fleet-street, London, E.C. 4. Paper, "Some Episodes in Early Ocean Steam Navigation," by Engineer-Captain E. C. Smith. 5.30 p.m.

ROYAL METEOROLOGICAL SOCIETY.—49, Cromwell-road, South Kensington, London, S.W. 7. Annual general meeting. "The Observation of Clouds, with Special Reference to the Safety of Aviation," by Dr. Hugo Hergesell; "World Weather," by Sir Gilbert T. Walker. 7.30 p.m.

ROYAL MICROSCOPICAL SOCIETY.—20, Hanover-square, London, W. 1. Presidential address, "Staining and Structure," by Dr. J. A. Murray. 7.45 p.m.

ROYAL SOCIETY OF ARTS.—John-street, Adelphi, London, W.C. 2. "Methods of Radiant Heating," by Mr. A. H. Barker. 8 p.m.

SOCIETY OF GLASS TECHNOLOGY.—College of Technology, Sackville-street, Manchester. Discussions on "The Design and Operation of Glass Furnaces," introduced by Mr. W. W. Warren; "The Manufacture and Use of Glasshouse Pots," introduced by Mr. P. Marson; "The Refining of Glass," introduced by Professor W. E. S. Turner. 2.30 p.m.

SOCIETY OF TECHNICAL ENGINEERS: LONDON BRANCH.—Visit to the Home Office Industrial Museum, Horseferry-road, London, S.W. 1. 6.15 p.m.

THURSDAY, JANUARY 19TH.

INSTITUTE OF METALS: BIRMINGHAM LOCAL SECTION.—The Engineers' Club, Waterloo-street, Birmingham. "Heat-resisting Alloys," by Mr. T. H. Turner. 7 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Watergate House, Adelphi, London, W.C. 2. London Graduates' meeting. "The Engineering Aspect of American Cars," by Mr. L. H. Pomeroy. 7.30 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS.—Savoy-place, Victoria Embankment, London, W.C. 2. Paper, "Large Electric Baking Ovens," by Mr. W. Ellerd-Styles. 6 p.m.

OPTICAL SOCIETY.—Imperial College of Science and Technology, South Kensington, London, S.W. 7. Papers: "On Toric Lenses," and "Canonical Forms in the Theory of Asymmetrical Optical Systems," by Mr. T. Smith; "Some Remarks on an Extension of the Optical Cosine Law," by Dr. M. Herzberger. 7.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. "Unsaturation of Carbon Compounds," by Professor J. F. Thorpe. 5.15 p.m.

FRIDAY, JANUARY 20TH.

INSTITUTION OF ELECTRICAL ENGINEERS: NORTH-EASTERN STUDENTS' SECTION.—Armstrong College, Newcastle-upon-Tyne. Paper, "Remote Control Systems," by Mr. D. E. Lambert. 7.15 p.m.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate, Westminster, London, S.W. 1. Fifth Report of the Steam Nozzles Research Committee. 6 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, London, S.W. 1. Paper, "Steam Accumulators," by Mr. S. Hopkins. 7.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. Discourse, "Photo-electricity," by Sir William Bragg. 9 p.m.

SATURDAY, JANUARY 21ST.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Town Hall, Devizes, Wilts. Southern District meeting. 12 noon.

FRIDAY, JANUARY 27TH.

INSTITUTE OF METALS: SHEFFIELD LOCAL SECTION.—Mappin Hall of the University, St. George's-square, Sheffield. "The Metal Aeroplane," by Mr. J. C. Buchanan. 7.30 p.m.

CONTRACTS.

HENRY BERRY AND CO., Ltd., of Hunslet, Leeds, have received an order for twenty-three sets of pumps of a special design from the Imperial Chemical Industries, Ltd. This order will, we understand, keep the firm fully employed for at least four months, and will find employment for an increased number of workers.

THE CONSTRUCTIONAL ENGINEERING COMPANY, Ltd., of Birmingham, has received orders for foundry plant, including cupolas, from the Brush Electrical Engineering Company, Ltd., the British Castings, Ltd., the Manchester Dry Docks Company, Brookes (Oldbury), Ltd., Beyer, Peacock and Co., Ltd., the Dudley Foundry Company, and for Singapore. The same firm has also received an order for an experimental melting plant from Mather and Platt, Ltd.

JOHNSON AND PHILLIPS, Ltd., of Charlton, London, S.E. 7, have received from the Corporation of Great Yarmouth an order for a 33,000-volt cable for linking up with Lowestoft. The order is for 19 miles of 33,000-volt three-core cable of the "H" type, with triple lead sheath and steel wire armouring, together with pilot cable and an 11,000-volt three-core distribution feeder cable to be laid in the same trench. The contract includes the laying and jointing of the cables.

LENTZ PATENTS, Ltd., of Stanley House, Dean Stanley-street, Westminster, S.W. 1, has recently received orders for Lentz poppet valve equipment as follows:—(*a*) five sets for L. and N.E.R., G.E. Section, for 4–6–0 type engines, 1500 Class; (*b*) two sets for the Bengal-Nagpur Railway G.S. Class 4–6–0 type passenger engines; (*c*) one set each for H.S.M. and H.S. Class 2–8–0 type goods engines; and (*d*) seven sets for K Class 4–4–2 type compound passenger engines. In the case of the compound locomotives the work required consists of new high-pressure cylinders complete with all fittings, together with poppet valves. In addition to the above six three-cylinder 4–4–0 type express engines are now being built at the Darlington shops of the L. and N.E.R. fitted with Lentz poppet valves.

JAMES AND FREDK. HOWARD, Ltd., of Bedford, ask us to announce that their South African representatives have just advised them that they have secured the contract for the extensions to the Bloemfontein municipal abattoir. "Howard" equipment will be supplied throughout and will consist of hoists, runways, pig sticking pens, scalding tanks, steel sliding doors, *&c.*, to suit the new cattle, sheep and pig slaughter halls. The installation will also include new lairages for all types of animals. Overhead runways, supported by Howard's independent steel supporting structures will be provided for the new hanging, chilling and freezing rooms. In addition to the foregoing, the same firm has secured, during the past month, orders for two large abattoir plants in Ireland and for a condemned sheep treatment plant for South America.